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FIELDS OF PSYCHOLOGY

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FIELDS OF PSYCHOLOGY

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Preface

For the student who should know in a relatively elementary way the substance of contemporary psychology in its many areas of investigation, this third edition has been prepared. The period of sixteen years since the second edition has offered numerous advances to be reported.

Progress in special areas has made necessary certain realignments and additions, especially in the professional fields. The death of Douglas Fryer and the withdrawal of Morris S. Viteles have been the occasion for two more compact chapters written by Floyd L. Ruch on Personnel Psychology and by Thomas W. Harrell on Managerial Psychology, respectively. An entirely new subject is the content of a chapter on Human Engineering, written by Neil D. Warren.

Another new chapter is that by William W. Grings on Experimental Psychology. The lack of such a chapter has previously been felt, and its absence could no longer be defended. To make room for these new chapters, the former chapter on Aesthetics was very reluctantly dropped. Relative weights had to be seriously considered, and in this area there has been regrettably limited progress.

Other replacements of authors have had to be made. The death of C. J. Warden made it necessary to enlist the writing services of Joseph R. Royce for a chapter on Animal Psychology. The death

of Horace B. English left two chapters in need of authors. Arthur T. Jersild accepted the assignment in the area of developmental psychology, with chapters on Child Psychology and Adolescence. W. Clark Trow was prevailed upon to write a new chapter on Educational Psychology. Another new author is Charles G. McClintock, who has prepared new chapters to replace those by Daniel Katz, who asked to be excused due to other commitments. Anne Anastasi and Laurance F. Shaffer have revised and updated their chapters on Differential Psychology and Abnormal Behavior, respectively.

The order of the chapters has been changed. The new principle is to begin with very general considerations, with Milton Metfessel's chapter on Points of View, followed by Experimental Psychology and Physiological Psychology, as fields of very general relevance. Then follow the special fields, dealing with different kinds of subjects, from animals to abnormal humans, and finally the professional fields.

This volume's editor is most grateful to the authors for their sincere efforts to make each contribution a significant and faithful picture of its field. He wishes to thank them for their willing cooperation and their patience during the more than three years in which this volume has been under preparation.

J. P. GUILFORD

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PART I: Orientation

CHAPTER 1

Introduction

When the history of science is written a hundred years from now, it will probably be noted that in the twentieth century psychology took its recognized place among the sciences, much as biology did in the nineteenth century, and physics and chemistry did in the centuries just preceding the nineteenth. It is possibly premature to say that psychology has already "come of age" during this century; it is difficult to say just when any science comes of age; its development is usually a continuing process, and it experiences spurts of development and periods of rejuvenation.

Fifty years ago it might have been said by unthinking observers that physics, chemistry, and perhaps even biology, not only had come of age but had acquired maturity and were just about completed. But the nuclear age has given both physics and chemistry spectacularly new growths, and molecular studies of heredity and of cell functions in general have given biology a similar new life. Although psychology has earned a place of respect among the sciences, it has yet to produce anything approaching the "bang" of an atomic bomb. Nevertheless, its impact, although much more subtle, has powerful implications for human welfare and human destiny.

HUMAN BEHAVIOR IN THE MODERN WORLD

It is trite to say that the last thing in the world man has subjected to scientific study is man himself. It is also trite to say that his progress in the physical sciences have been so much more advanced than in the social sciences that human knowledge is dangerously unbalanced. The critical result is that his control over inanimate forces, either for good or for ill, has increased tremendously his possibilities of self-destruction. It is well recognized that these possibilities for self-annihilation must be balanced by new measures of self-control and social control if man is to survive. The improvement of these controls will depend very much upon an increased knowledge of how man behaves, particularly of how he interacts with his fellows. This knowledge must be supplied from its most obvious sources, namely, psychology and its neighboring disciplines, the social sciences—

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economics, political science, sociology, and anthropology, sometimes called the "behavioral sciences." In many respects, psychology is the basic behavioral science, for all of them are concerned with principles of individual behavior and of group behavior.

It is one of the most basic axioms of psychology that human actions, like those of all living, reacting creatures, are largely determined by stimulation, external and internal, past and present, to which individuals are subjected, and to built-in arrangements in their nervous systems. The average person today is subjected to stimulation that is exceedingly varied and complex, as compared with that of his ancestors, and very much richer in social components. The growth of populations, and of centers of population, the increased amount of travel, and particularly the perfection of modes of intercommunication, are all factors bringing about closer and more numerous contacts among individuals, with vastly increased inter-stimulation and interaction. The modern individual, as compared with his ancestors, lives in a welter of stimuli of social origin, much of it verbal, either in spoken or written form. The avenues of communication are so numerous in most civilized countries that we are almost constantly bombarded by stimulation, even from the far corners of the earth. What we do, or decide to do, what we feel or think at breakfast tomorrow morning may be determined to some extent by what happened in London, Moscow, Berlin, Tokyo, or the Congo only a few moments before. Moreover, what the masses of people do or say or think is similarly determined by the same types of stimuli.

The avenues of communication have been highly valued and have been generally exploited for the control of populations of people. Revolutionary political parties and individuals who crave power over others are quick to seize upon these channels for the transmission of information, whether the information be called "education" or "propaganda." Psychology is being applied as never before, through these media and otherwise. Struggles among peoples are more than ever fought by means of barrages of words rather than bullets. Whether the efforts to control other people are made with intentions that may be regarded as good or bad, the refinement in methods of control depends especially upon the discovery of psy-

chological principles of human reactions and thinking.

The development of social institutions and regulations that permit men to live together in peace and to develop along the lines of their talents and their desires and aspirations also requires full recognition of psychological principles. Many of these principles, it must be admitted, are as yet only partially understood. It is also true that many of them have always been applied by wise leaders without full conscious realization of those principles. Such leaders have been functioning as "naive psychologists," just as most of us function in our material environments as "naive physicists." In both cases, achievement of conscious, verbalized understanding of the principles has made available to a much wider population the means for more effective living with one's fellows. The most urgent problems of the present time are those pertaining to human relations, in their political, industrial, and social aspects. Upon reasonable solutions of these problems human destiny depends.

PSYCHOLOGY AND MODERN LIFE

WHY THERE ARE FIELDS OF PSYCHOLOGY

Although the primary interest of man is man himself, and although the practical aims of psychologists have been to make better men and to make men better, the science of psychology reaches into every corner of the animal kingdom. In its broadest sense, psychology is the study of the things that all living organisms do as species and as individuals. In the study of man, in particular, it is led to examine *homo sapiens* in all his forms and in all his relationships, lest some significant fact about him escape notice. Examining, as it does, the lives of all organisms, high and low in the biological scale, and embracing man in his many-sided connections, psychology naturally tends to branch off in specialized directions, thus creating recognized fields. This is true not only in its attempts to discover basic facts and principles but also in the application of those facts and principles to human problems. The walks of life and the many problems of life that draw upon psychological knowledge are even more numerous and varied than the sources of the basic

information from which psychological knowledge of a general nature is drawn.

There are, in brief, many fields of applied, or professional, psychology, as well as many fields of basic psychology. In the chapters to follow, we shall be interested in both kinds of fields; those in which investigators search for general psychological knowledge and those who furnish the link between that knowledge and its use in daily life. We shall see what kinds of things the psychologist does as a scientist in his laboratory and in his field research, and we shall see what he does in his clinic and office where he functions as a new kind of "human engineer." We shall see what many of his appealing problems are and something about the general procedures by which he proceeds to find the answers to those problems. We shall see how his discoveries lead to changes in human understanding, thinking, and attitudes, potentially touching the lives of multitudes of people who do not even come in contact with him.

HOW PSYCHOLOGY CHANGES WAYS OF THINKING

As an example of how a science can turn the ways of thinking of people in new directions, we may cite the teachings of Charles Darwin concerning the evolution of the species. As an example from earlier history, the teaching of Copernicus that the earth is not the center of the universe will serve. Such revolutionary ideas not only change human thinking but also people's ways of living and acting as well. The teachings of psychology now have and will probably continue to have more important influences upon people's ways of looking at life, particularly with respect to themselves and their associates. References to Albert Binet, Sigmund Freud, and John Watson and to their techniques and teachings is sufficient basis for the last statement; there are others, less well publicized, who have also had their social influences. With the possible exception of the Freudian influence, psychology has wrought no sudden revolution, such as that provoked by Darwin, possibly because we are now more prepared for the changes that it brings about. But the changes are nonetheless real and doubtless just as profound, when one thinks of effects on education, child rearing, and the handling of misbehavior.

Attitudes Toward Misbehavior. It is one of the

aims of the following chapters to suggest what some of the important changes are. Even when not pointed out explicitly, those changes may be seen by implication by the alert reader who reads between the lines. Some of the changes are now so commonplace that they can be appreciated only by contrast to conditions that applied in former generations. As one example of change let us consider the general attitudes of parents and others toward misbehavior. The traditional causes to which misbehavior has been attributed include such things as "temptations of Satan," "animal instincts," "bad heredity," or "sparing the rod and spoiling the child." Naming one of these "causes" often excused the parent or teacher of blame or led to drastic efforts to counteract the "bad" influence by measures that may have left the child in an even less desirable condition than before.

Psychologists, on the other hand, are likely to consider misbehavior, like all behavior, as the outcome of natural forces working in more or less well-known ways. The solution is to discover what forces are operating in any particular child and to apply the necessary corrective measures. The psychologist's attitude toward misconduct is much like that of the medical doctor toward a physical disease or defect. A disorder must be carefully diagnosed and then treated. In other children, preventive "medicine" in the form of "mental hygiene" can be exercised in order to forestall future potential misbehavior.

The reference to natural causes for behavior raises some deep philosophical issues which cannot be gone into here. On the one hand, a science habitually thinks in terms of events determining other events. The science of behavior of living organisms adopts that principle and acts as if it generally applied.

A simple story illustrates what implication may be drawn from the idea that all behavior is determined. A man who was being sentenced for a misdemeanor was asked whether he had any comment to make. "Yes, your Honor," he said, "what I did was determined by my unfortunate heredity and my unfortunate environment. I am not to blame, therefore I should not be sentenced." In other words, a blow has been struck against the principle of individual responsibility.

But note that it is not necessary to assume that

the principle of determination applies 100 per cent. Even in physics, in recent years, we hear of some room being left for some indeterminacy. Psychology, with its relatively lower degree of precision in prediction and control, has certainly more than a little room for indeterminacy. Even granting a very high percentage of determination, it should be recognized that the individual can still develop a high degree of self-determination or self-control, as democratic society has always expected him to do. In other words, self-control, too, can be determined and can be a determiner.

The Clinical versus the Personal Attitude. As another example of change or difference in attitude, consider another aspect of misbehavior; the problem of relative seriousness of different kinds of conduct. Some thirty years ago, parents and many teachers, too, were questioned on this subject. They almost invariably placed at the head of the list of serious misbehaviors such things as stealing, cheating, lying, disobedience, obscene talk, swearing, smoking, and the like. Psychologists who were questioned, on the other hand, were more inclined to place among the more serious types of behavior such things as fits of depression, unusual fears, cruelty, constant whining, withdrawing from social contacts, sulkiness, and the like.

The difference is one of fundamental point of view. Parents, and many teachers, regarded as most serious that behavior which transgresses conventional moral standards, or is in opposition to parental control, or is disrupting to the comfortable routine of home or school. Psychologists, on the other hand, look for the symptoms of graver maladjustments possibly to come. They are disturbed at signs of the child's unusual withdrawal from life situations, of nervousness, and of unusual ways of getting what he wants, for example, by means of temper tantrums. They know that certain habits, if persisting, will later make the individual ineffective and unhappy.

No one, of course, not even a psychologist, condones infractions of the moral code, such as stealing, lying, and the like. The psychologist, however, recognizes that such infractions are often less prophetic of a disastrous future for the child than other kinds of symptoms that he takes more seriously. He knows, too, that adult crime often grows out of childhood maladjustments as indicated by those symptoms.

We might summarize these two different out-

looks on misbehavior by saying that the parent exhibits a more personal, moral attitude in that he is concerned about behavior that disturbs him or will reflect upon him personally. The psychologist takes a more impersonal, detached, clinical attitude in that he cares less about the immediate consequences of the child's act than he does about the child's future development into an effective, useful, happy adult. The time will undoubtedly come when parents and teachers will catch more of the clinical spirit in dealing with troublesome behavior in their young charges. When they do, we shall see a great improvement in the way in which the young are brought up and a marked decrease in wastage among adults. This is not to say, of course, that parents and teachers can dispense with the more immediate measures that are required in dealing with infractions as they occur. Nor is it to say that no parents are doing an excellent job of child rearing, for many of them are.

OTHER WAYS IN WHICH PSYCHOLOGY TOUCHES MODERN LIFE

These limited examples are only two of many that show how psychology can change modern life. They have to do with the rearing of children. Other phases of life could readily be mentioned as examples, but these must be left almost entirely to later chapters. Suffice it to say here that the field of education, for example, undergoes revisions from the nursery school through the graduate school largely because of psychological discoveries and practices. Knowledge of psychology has important bearings upon the philosophy of education which deals with the aims and objectives of education. A knowledge of man, how he develops and what he can become, suggests what to do about his educational destiny. Decisions with respect to the philosophy of education lead to decisions regarding curriculum and directions of educational effort. Knowledge of how we learn and how we think and solve problems lends scientific bases for strategies and tactics of teaching. A comparison of today's textbooks, teaching aids, and examinations with those in use even thirty years ago will show some radical changes. The introduction of psychological tests has given to education certain indispensable tools for adjusting the child to the school and the school to the child, for educational and vocational guidance, and for numerous other useful purposes.

The professional psychologist has also found application for psychological facts and principles in the market place, the industrial plant, the penal institution, the courts, the medical clinic and hospital, and in political affairs. In fact, wherever it is necessary to deal with people, whether it is their selection for employment, their assignment to types of work, their training, their guidance, their attitudes, preferences and interests that are concerned, there is a place for the use of psychological knowledge and methods. For a survey of all such applications the reader is referred to later chapters.

GENERAL PLAN OF THE VOLUME

The organization of the chapters in this volume is in three major divisions, following two introductory chapters on general orientation. The first of these divisions is devoted to two general, basic fields that make no choice as to varieties or organisms or of human kind. They have to do with methods and with problems that have very wide application, but which, on the whole, start with the study of the mature, human adult. The second major division deals with special, but also basic, fields in which attention is turned toward the behavior of lower animals, toward abnormal behavior and behavior in groups, toward developmental changes throughout the life span, and toward phenomena of individual differences in behavior. The final major division is devoted to the professional fields of clinical psychology, educational psychology, and vocational and industrial psychology.

The chapter immediately following this one presents some of the theoretical background of psychology in general. There has not always been peace within the psychological family. There have been many different opinions as to what psychology should be and what it should do, as well as opinions about how it should obtain its data and interpret its results. In the past, from time to time, new "schools" of psychologists or new points of view arose—existentialists, functionalists, behaviorists, psychoanalysts, Gestaltists, and others. New movements usually grew out of certain dissatisfactions with the old and reacted against existing schools of thought. The development of a "science of mind," as it was known in earlier times, has been a very frustrating experi-

ence, and there has often been room for discontent and even frustration at seemingly slow progress.

But each new movement has left its contributions, and those of recognized value have been incorporated into the main body of psychological knowledge and theory. Not all the issues that the conflicts aroused have been resolved, but reconciliations on many points have been achieved. For some years, now, it can be said that no new "school" of serious pretensions has been initiated, a sign of the condition of relative peace that now prevails. As of the date when this volume was being written, the dangers of civil war appeared to be low. There is rather a danger that increasing specializations, even within fields, is leading to lack of mutuality of interest and to inadequate communication among members of the psychological family. The student, especially, needs to be reminded of the essential unity of the science and the profession of psychology and to seek to achieve the kind of overview that this volume attempts to provide.

THE BASIC, GENERAL FIELDS

In its traditional sense, experimental psychology is the oldest of the fields. Originally, experimental psychology was almost indistinguishable from physiology. More than a hundred years ago, philosophers who were concerned with the general problem of how we can know anything became impressed with the new physiological knowledge about the human senses and their obvious roles in acquiring information. They recognized that many questions about how we acquire knowledge could be answered by going into the laboratory, investigating the ways in which our senses give us perceptions, and discovering what information from those perceptions can be utilized in rational thinking. Experimental procedures and the logic of investigation through scientific experiments spread slowly to other problems of the human mind in efforts to find out how we remember, think, feel, and act.

The early investigations of experimental psychology were focused very much upon the normal, human adult. Although laboratory psychology with similar interests has continued through the years, the experimental approach has been extended to all the specific fields as well as to utilization by professional psychologists in solving their

immediate problems. Thus, although no one field has an exclusive claim to experimental methods, there is a tradition for keeping the normal, human adult as the common reference point and reason for an appropriate continued recognition of a field of experimental psychology. The chapter on this subject emphasizes the logic of experimental method and the reasons for giving serious credence to findings that have been derived from its rigorous procedures.

That psychology has never become completely divorced from physiology is seen in the persistence of the field of physiological psychology. From the early investigations of the senses and the relations of sensory functioning to sense organs, there has been a broadening of interest in correlating mental events of all kinds with all kinds of bodily structures, including nervous tissue, muscles, and glands. To the physiologist who studies the functioning of the brain and the entire nervous system, it is impossible to do without psychological descriptions of behavioral events that are associated with those structures. To the psychologist whose curiosity leads him to question what kind of bodily events underlie and are essential for certain mental events that he observes, it is impossible to avoid parallel observations of the functioning of bodily structures; hence, physiological psychology.

THE MAJOR SPECIAL FIELDS

The sequence of the special fields, in the chapters that follow, appropriately begins with animal psychology, following a general phylogenetic order. Animal psychology actually had its roots with the naturalists, who predated the science of biology. The behavior of animals has always attracted the interest of human observers; one has only to watch human beings at a zoo to accept this statement. Changing conceptions of life, of human nature, and of mental phenomena—in fact, conceptions in philosophy in general—have run parallel to changing attitudes toward animal behavior. For those who believe that human characteristics have undergone a long course of development from simpler to more complex forms, the study of lower-animal behavior is very significant. One would not need to subscribe to the idea of human evolution, however, in order to appreciate the findings of animal psychology.

Many a principle that helps us to understand *human* nature has been discovered by the study of lower animals. Furthermore, as in the medical and physiological fields, many a study of animals cannot be duplicated with human subjects owing to their costliness in terms of human comfort and human life.

The chapters on child and adolescent psychology follow with an ontological view of mental development. Although probably very few theorists now hold that "ontogeny repeats phylogeny" (individual human development duplicates racial development), there are some parallels. The child's development furnishes some links between animal psychology and human adult psychology. Even if there is not complete continuity in development between animal and adult human behavior, the child's life does provide some intermediate levels of psychological functioning. Certainly, because of our interest in promoting optimal development in children and youth and because it is important to know how the adult becomes what he is, the understanding of development through childhood and adolescence is very important.

Development results in individual differences, both because of differing environments and in spite of similarities of environment. It would be a very monotonous world if all human beings were made from exactly the same pattern. Variability has been a key condition for all improvement, both genetically and in terms of social progress. There is interest in the various characteristics or ways in which individuals differ from one another, in just how great the differences can normally be, in the various influences that produce those differences, and in the implications of those differences for society and human welfare.

References to society and human welfare readily suggests another field; that of social psychology. There has often been difference of opinion as to where the emphasis should be: whether on the behavior of individuals in social settings or on the behavior of groups of individuals in which groups are conceived as having some kind of organic unity, and whether, because groups are made up of individuals, the behavior of groups can be adequately accounted for by understanding how individuals react to social stimulation. The two chapters to come on this field strike a balance with respect to the issues and recognize the significance

of both a social individual and the reality of groups.

The expression "abnormal psychology" does not mean that it is the psychology that is abnormal; it means the field that deals with abnormal behavior, as the titles of three chapters indicate. Abnormal behavior is action that deviates markedly from the common or expected, or falls notably short of social standards. Abnormalities vary all the way from minor departures (subnormal performance, "queer" actions, and the like) at the milder extremes to serious transgressions, dangerous or insane actions, or a helpless condition at the other extreme.

The historic recognition that there are nervous and mental diseases as well as physical diseases is one of the great steps forward in modern thinking. The revolution in human attitudes toward the insane and the neurotic is not complete but it has been radical in character. The limited, although substantial, understanding of abnormal behavior and its foundations has not only improved the chances of helping victims of it and of preventing it in others but has also advanced considerably our knowledge of the normal individual.

PROFESSIONAL FIELDS

Of the professional fields, the one most related to problems of abnormal behavior is clinical psychology. Since World War II, clinical psychology has represented a rapidly growing profession that takes its place alongside general medicine, psychiatry, and social work in working with the individual who needs a more effective method of dealing with his environments in order to enhance the possibilities of his being a contributing member of society.

Educational psychology supplies the links between experimental psychology, developmental psychology of childhood and adolescence, and the field of individual differences, on the one hand, and practices and policies in education, on the other. Psychological knowledge by itself is not sufficient in the face of the demands of practical operations. Usually much developmental research is needed before any basic fact or principle can be put to work in specific kinds of situations in the solution of particular kinds of practical problems. Just as the field of medicine draws its basic

information from physiology, bacteriology, chemistry, and so on, and adapts that information to procedures of surgery and other techniques of the profession, the field of educational psychology serves a parallel function with respect to the instruction and development of individuals.

What was formerly known as a single field of "industrial" psychology, now appears to have branched out into subdivisions. At least there is an outgrowth in recent years sometimes called "human factors" and sometimes "human engineering," which is treated in the last chapter of this volume. Other aspects of industrial psychology that have sometimes been known as "vocational psychology" are sometimes divided along the lines of "personnel psychology" and "managerial psychology." This kind of division is reflected in Chapters 17 and 18.

Personnel psychology deals with problems of the selection of personnel, which draws heavily upon the psychology of individual differences and the techniques of measurement of those differences. In connection with the selection of personnel, there is also the problem of classification; that is, deciding among those who are employed which ones should go into one kind of specialization and which into other specializations. There are problems of training, which shares some of the problems of educational psychology and the basic psychology of learning and memory.

Once personnel are selected, classified, trained, and assigned to particular work tasks, there are problems of management. Managerial psychology deals with problems of morale; how to bring out the best efforts in employees and how to promote smooth-running relationships between levels of management and within levels.

The human-factors specialists came into being during the past twenty years. Military problems, especially, called attention to the need for improvements in machines that men operate. One can select the men with the greatest promise for successful operation of equipment, such as a tank, an aircraft, submarine, or a radar scope, but those men may still not be optimally successful if the equipment is poorly designed; if by the nature of its design they cannot utilize their skills or are led into making costly mistakes. It is necessary to adapt the machine to the man as well as the man to the machine, hence either the engineer who de-

signs equipment must know the pertinent psychological principles or must have the collaboration of a psychologist who can cover the human aspects of design development.

SOME MISCELLANEOUS FIELDS

Even the several chapters dealing with the better-recognized special and professional fields do not cover all the possible areas touched by psychologists. There are several other fields of basic investigation and numerous other types of professional service that could have been given attention if space were available.

In view of the increasing numbers of elderly people in our population, there has been a growing activity in the study of the psychological characteristics of behavior in the years of decline, as a part of a broader field of gerontology. Beginning with Fechner, one of the founders of experimental psychology, over the decades a few psychologists have given special attention to problems of aesthetic reactions; responses to the beautiful, or behavior involving appreciation of things artistic. In keeping with advancing knowledge about drugs, a relatively new field of psychopharmacology has been developing, for many drugs have their psychological effects which must be determined. A very limited number of psychologists have devoted their energies to the investigation of parapsychology, looking into the possibilities of human perception of events without using the normal sensory channels; of the direct trans-

mission of information from person to person other than through the known senses; and the possibility of personal control of physical events by mental exertion other than through the customary use of muscles. Although such problems can be tantalizing, results have been difficult to evaluate, as yet. To return to more mundane areas, some psychologists are currently investigating human behavior in relation to economic and political affairs. Since the economics and the political affairs of a population rest very heavily on the perceptions, attitudes, and thinking of individuals, a full comprehension of such affairs requires a grasp of psychological aspects.

Among other professional psychological specialists a few may be mentioned. One rather large group is concerned with counseling. This may take the form of educational and vocational guidance, as practiced by school psychologists, by clinical psychologists in industries, or by counselors in private practice. There are psychologists who are concerned with legal problems and practices. Others are concerned with problems of advertising and public relations. There is a psychology of music and there is military psychology, and there are practicing hypnotists (not to be confused with public entertainers), and there are still others who deal with speech and speech pathology. Name almost any sphere of life in which human or animal behavior is of some significance and you will indicate a place where psychological service may be needed.

CHAPTER 2

Points of View

In the pages of this volume you will be introduced to the vast area of human knowledge covered by the several fields of psychology. Is there a system of thought which can be found to organize the facts and ideas of the separate fields into a consistent whole? Psychologists in the past have been motivated to attempt an answer to such a question. Many problems have been encountered, with the result that different solutions have been presented. It is our task in this chapter to examine outstanding attempts to characterize and organize psychology as a whole.

The various thought systems have been developed by many psychologists. Because our presentation is of necessity limited, it is impossible to do justice to the splendid contributions of a large number. For purposes of simplicity, one or two men have been singled out as representative of a system of thought.

Another limitation we impose on ourselves can be found in our emphasis on the positive aspects of each viewpoint. To be sure, there are many salient differences between the various approaches, but they become a matter of greater interest as one progresses in the study of psychology.

During the period from about 1900 to 1930 each system of thought had a number of enthusiastic adherents who worked in terms of the interpretations the particular system provided and regarded other views as unsatisfactory. Partly as a result of this divergence, the various viewpoints came to be known as *schools of psychology*, of which the most important were the *existential*, *functional*, *behavioristic*, *psychoanalytic*, and *gestalt* or *field psychology*. However, in recent years there has been rather general recognition that each of these approaches has much to contribute. Clear-cut schools of psychology are less in evidence; and most psychologists do not limit themselves to a single viewpoint in interpreting human behavior.

VIEW OF SIMPLE EXISTENCES

Edward Bradford Titchener, the great American psychologist who spent most of his productive

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years at Cornell University (1892-1927), viewed psychology as the science of such experiences as sensations, emotions, and thought. He was a man of unusual interests, one of the few who wanted to know the nature of mental processes in and of themselves. He was more intrigued with knowing what perceptions, emotions, and thoughts are than in knowing how they function in everyday life.

DESCRIPTION IN SIMPLEST POSSIBLE TERMS

With Titchener's viewpoint, the first task of the psychologist is to describe conscious experience in the simplest possible terms. Such a description is called an *introspection*. There must be sampling of all manner of experiences from sensations to higher thought processes. Can a thought process be reduced to simpler mental processes? Titchener's answer was in the affirmative, for his analysis showed that thought is made up in part of images. Thus numerous experiences are worked over introspectively, splitting them into component parts until further analysis is impossible. An experience that cannot be divided is an elementary mental process, a simple *existence*.

At best, introspection is an arduous and difficult task. Living as we do in a world of objects, there is always danger of referring the experience to a physical object. If a student is asked to analyze the contents of his thoughts into simple existences, he is quite likely to state *what* he was thinking of, as for example, a trip to Europe. An existential psychologist would want to know the mental processes that went into the thought "trip-to-Europe": visual images, muscular sensations, and so on.

ANALYSIS OF AN EMOTIONAL EXPERIENCE

Titchener has given the following example of how an experience can be divided into various mental processes:

Suppose that you are sitting at your desk, busy in your regular way, and obscurely conscious of a rumble of a car that is passing down the street; and suppose that the rumble is suddenly interrupted by a shrill scream. You leap up, as if the scream were a personal signal that you had been expecting; you dash out of doors, as if your presence on the street were a matter of imperative necessity. As you run, you have fragmentary ideas: "a child," perhaps, in internal speech; a visual flash of some previous

accident; a scrap of kinesthesia that carries your whole attitude to the city car-system. But you have, also, a mass of insistent organic sensation: you choke, you draw your breath in gasps, for all the hurry you are in a cold sweat, you have a horrible nausea; and yet, in spite of the intense unpleasantness that floods your consciousness, you have no choice but to go on . . . the mental processes that we have just described make up the emotion of horror (Titchener, 1919, p. 471).

In this experience were perceptions of various phases of the whole situation, ideas, memory, attitude, kinesthetic sensation, organic sensation, and unpleasantness. Which of these can be reduced further? Titchener suggested that attitude was made up of kinesthesia, or muscular sensation; that memory of a previous accident was a visual flash; and that the idea was made up of the combined muscular sensations and auditory images of a word, *child*.

THE SIMPLEST PSYCHOLOGICAL EXISTENCES

From introspection of many experiences, Titchener drew the conclusion that there are three classes of elementary mental process: sensations, images, and affects (feelings). Titchener found that he could describe every perception of meaningful sights and sounds as groupings of simpler meaningless mental processes of sensation. Sensations are, therefore, the characteristic elements of perceptions. In every idea that he analyzed, he always came across an image; and in every emotion, he found pleasantness or unpleasantness which taken together he called affect. He found that any given moment of experience is an exceedingly complex array of mental processes. Even perceptions, ideas, and emotions have to be singled out from each other in the total experience, before their own nature can be examined and an analysis made into sensations, images, and affects.

CLASSIFICATION OF MENTAL ELEMENTS

Someone told Titchener that if he reduced all mental life to simple existences, it would be impossible to classify them. Titchener replied that although the mental elements are simple, they are still actual processes, and as such, they have various aspects or attributes. Sensations may be classified, for example, in terms of the attribute of *quality*. Thus, the tone of a violin is distinguished from the sight of the violin by quality of sensation.

Sensations also have four other attributes: *intensity*, *clearness*, *duration*, and *extent*. They can be differentiated from each other and grouped on the bases of these attributes.

Titchener also classified experience with reference to parts of the body, such as muscular sensations from the vocal organs or from the eye. Another means of classifying uses the stimulus as a reference point.

SUMMARY

Titchener and other members of the existential school were concerned with studying the nature of conscious experience and with determining the simplest psychological existences from which all conscious experience is structured. (The school of thought is, alternatively, called the *structural school*.) Using introspection, three elementary mental processes were noted: sensations, images, and affects. These were classified according to their attributes, by reference to parts of the body, or by their stimuli. Of the three, greatest emphasis was given to the study of sensations. Numerous contributions from the existentialists have an important place in sensory psychology today.

VIEW OF ADAPTATION TO ENVIRONMENT

The idea of evolution, originating in biology, was carried over into psychology. Whereas biology was interested primarily in the relation of bodily features to the preservation of life, psychology inquired into the role of consciousness in adaptation to environment. Sense organs, muscles, nerves, and glands contributed to the continuation of life, but did not conscious processes provide important means to the same end? This viewpoint came to be known as functional psychology, since the whole field was organized in terms of the ways in which consciousness functioned for the welfare of the living being.

THE ADJUSTMENT OF INNER TO OUTER RELATIONS

Herbert Spencer, an Englishman, was one of the first to lay the foundation for such an organization. He thought that our understanding of psychology was not a matter of what went on in consciousness alone, but that the environment had to be taken into consideration. All events inside the

organism, or internal relations as he called them, were in some way connected with external relations, or the environment. Mental life, no less than bodily life, is a continual adjustment of the internal relations to the external relations.

ENVIRONMENTAL DEMANDS MET BY REFLEX AND AUTOMATIC ACTS

Human beings are equipped by heredity to make certain adjustments to the environment without a long process of learning. One of the simplest examples of the adaptive process is the eye-wink reflex. If an object is thrown toward your eye, in a split second the lid closes as a protective gesture. Another illustration is the pupillary reflex, which automatically adapts to strong light by shutting out some of it, and to weak light by admitting more.

Acts such as walking, talking, and writing when first performed require considerable attention. We are conscious of the acts themselves as we learn them. It is fortunate that we do not have to devote as much attention to them throughout our lives. They become automatic. Having learned to go through the movements of typing, for example, we no longer pay attention to them and are free to concentrate on the thought of what we are writing. Much of what we do day in and day out is of routine nature. Consciousness steps out of the picture when it is no longer needed.

CONSCIOUSNESS AS PART OF THE ADJUSTIVE PROCESSES OF AN ORGANISM

James Rowland Angell, one of the leaders of the functionalist school at the University of Chicago and later President of Yale University for many years, pointed out that consciousness becomes a "master device" in adjusting to the environment when hereditary acts or learned automatisms fail us (Angell, 1908). Driving an automobile involves a complicated coordination of movements—turning of the wheel, foot action on accelerator, etc.—ordinarily left to the nervous system for successful operation. While driving in situations that are not dangerous, you may forget that you are driving an automobile. If, however, another car looms up unexpectedly, you quickly become aware of your driving. Consciousness comes to your aid to help you out of the situation.

Since we never reach a complete and final adjustment until death, we have a recurrent series of

one adjusting process after another. As a result our conscious processes are called into use frequently to assist in making adjustments. Bodily and mental life cooperate; the entire organism is involved.

USES OF EMOTION AND FEELING

Angell's point of view of the way in which conscious processes function in the interest of man's survival can best be illustrated by his treatment of emotion and feeling. Darwin made exhaustive observations of various emotional attitudes in men and animals and tried to trace the value in adjustment of screams, growls, tense postures, and erection of dermal appendages such as hair and feathers. An animal's strong, harsh cry of rage has a possible value of frightening an adversary. In civilized man, the value of such emotional expressions is probably less than in animals.

Intense fear and anger do serve us, as Angell pointed out. They represent a compelling break in the continuity of our mental life, and make us acutely aware of a crisis and the necessity for an adjustment to it. Angell's idea was that a strong emotion appeared when there was a conflict between normal impulses arising out of special situations.

The feelings of pleasure and displeasure connected with emotional life are by nature tied up to the purposes of the organism. According to one view, if our mental activities move along unimpeded toward a given end, we feel pleasant. If, for any reason, there appears a thwarting of progress toward that goal, we feel unpleasant.

SUMMARY

We have seen that existential psychology is limited to our "internal" experience, although it uses the "external" world for purposes of classification. Functional psychology is colored throughout by its concern with the relationship of consciousness to environmental occurrences. Consciousness is viewed as one of the devices by which man adapts to his environment, entering the picture when nonconscious, automatic activities fail and cooperating with bodily life to help the individual adjust to whatever situation he faces.

VIEW OF STIMULI AND RESPONSES

In marked contrast to existential and functional psychology, a third view leaves out all reference

to experience or consciousness and confines itself to a study of the relationship of various stimuli which impinge on an organism to the responses made by that organism. It is known as behavioristic psychology.

ANIMAL LEARNING

At the beginning of this century, some psychologists were occupied in researches on instinct and learning. They found they could control experimental situations much better with animals than human beings. Edward L. Thorndike, famous Columbia University psychologist, was one of these early experimenters on animals. His classical experiment with a kitten learning to escape from a box is a good example of stimulus-response psychology (Thorndike, 1898). Stimulus for the animal was a box with a door that could be opened to get a piece of fish. The response necessary to solve the problem was turning a button. The kitten made a large number of movements with paws, mouth, and other parts of its body. Most of them were useless. Some of the movements were made at the button; and when the button was turned, the door opened. The next time the kitten was put in the cage, it did not go immediately to the button, but repeated a number of useless movements. However, some were eliminated, since the kitten took less time to get out. As trials were repeated, more useless movements were dropped. The connection of the appropriate response to the confinement stimulus was gradually strengthened, or in Thorndike's words, stamped in.

It is obvious that an animal cannot make observations of his experience and report them verbally to a scientist. Thorndike and others who worked with animals had to speak of learning objectively in terms of stimulus and response, whereas previously it had been described as subjective association of ideas. The techniques which the animal experimenters used were valuable in studying the nature of learning.

PSYCHOLOGY STUDIED IN OTHER PERSONS

Since methods of animal psychology were so successful, they were applied to human beings. In a book entitled *Psychology of the Other One*, Max Meyer contended that the study of psychology would be more objective and scientific if the psy-

chologist left himself out of the subject matter (Meyer, 1921). Besides believing that analysis of the conscious experience of the psychologist should be eliminated from the study, he doubted that consciousness could be studied in other people, because he considered it a personal matter. He suggested that the whole of psychology could be written without recourse to consciousness. For instance, in place of thought, we can study language; for the symbols of thought are subjective and personal, while those of language are objective and social. Likewise, it is unnecessary to say that an animal moves about in search of food because he is hungry, since the word *hunger* refers to an animal's conscious state. Meyer states that it is more consistent to say that an animal moves about because there is no food in the digestive cavity. The movements, food, and digestive apparatus all belong to the same category of objective realities. This attitude may be clearer if we consider our objections to stating that a plant grows roots into the ground because it is hungry.

MEASUREMENT OF RESPONSES

Meyer pointed out that the great discoveries of science have been made when the scientist restricted his descriptions to that which he could measure. When we measure, we use sense organs, primarily our eyes. As far as is known, our sense organs cannot receive conscious experiences, and consciousness is not directly measurable. With responses, however, behaviorists tell us it is different. We can measure actions of muscles and glands, and later determine their significance.

Although a muscular response is a result of a stimulus, it is not an immediate result. Before a muscular response can take place, nervous excitations have to travel from sense organs to the central sections of the nervous system and then to muscles. In the solution of many psychological problems, however, it is possible to disregard the intermediate nervous excitations. An example is found in the relation of reaction time to traffic accidents. One of the first things studied with accident-prone drivers is the time it takes them to push down a brake pedal after a stimulus has been given. If a driver shows that he is slow compared to others, or that he is highly variable, fast at one time and slow at another, it is unnecessary to find out what went on in sensory and motor impulses of his nervous system.

THE STIMULUS-RESPONSE FORMULA

John Broadus Watson is the psychologist most often associated with the behavioristic viewpoint (Watson, 1919). In addition to his writings on this approach, he is well known for stimulus-response studies of young children. Very widely cited is the investigation in which a young child was conditioned to fear a white rat by presenting the animal a number of times along with a very loud noise (Watson and Rayner, 1920).

Watson's keynote for psychology is, "Give a stimulus, to predict a response." Man's actions occur in a world of law and order. It is admitted generally that what any given individual does can be traced in part to preceding conditions in his life. It is from these preceding stimuli that we can predict some behavior even by common sense. To be sure, our predictions are not perfect, but we rely on them. A bank cashier predicts that the loans he makes will be repaid. A personnel manager predicts that individuals of his choice will be successful in the positions to which he assigns them. As we become more closely acquainted with a friend, we can better map out in advance what he will do in any given situation.

SUMMARY

The behavioristic viewpoint emphasizes study of measurable movements of an organism in relation to the stimuli preceding those movements. The subject matter of psychology consists of activities, and those activities can be organized according to the formula: Given a stimulus, to predict a response. Behaviorists hold that the facts of psychology can be ascertained in objective terms and that a description of consciousness is not essential.

VIEW OF UNCONSCIOUS PROCESSES

This viewpoint developed from the work of a number of European medical men and psychologists as they dealt with patients whose disorders could not be attributed to physical disease or damage. Included were cases of disabling anxiety, abnormal fears, compulsive acts, paralysis or loss of sensation with no basis in physical impairment, multiple personality, and other neurotic symptoms. To help interpret such strange and irrational occurrences, they looked for explanations in unconscious aspects of their patients' lives. According to

this view, some events are below the surface of consciousness but, nevertheless, have a powerful influence on how a person feels and behaves. This point of view is variously known as *depth psychology*, *psychoanalytic theory*, and *Freudian psychology*. The last term reflects the tremendous importance of Sigmund Freud, a Viennese doctor, in development of this school of thought.

REPRESSION OF DISTURBING MATERIAL

One of Freud's professors had noted that persons suffering from neuroses generally had some difficulty in their sexual lives. Freud saw the significance of this observation and proceeded to search for the relation of sexual difficulties to neuroses in his treatments. He found that patients were ashamed to discuss these troubles, but that if they could be brought to recall and talk about their past experiences along this line, a sort of mental catharsis took place, and the neurosis was relieved.

Freud found that recollection of these troublesome experiences was exceedingly difficult. He became convinced that patients had actually forgotten the original sexual episodes. He also was satisfied that it was those experiences that somehow were the cause of the neuroses. What was the process by which these vivid emotional experiences were forgotten? How did they possess a strange power to change an entire personality?

In building a psychological system to answer these preliminary questions, Freud adopted a picturesque terminology (Freud, 1936). He conceived of the personality, or "psyche," as being partly conscious and partly unconscious. We are aware of the external world and certain aspects of ourselves, but we are ignorant of the deeper and more powerful forces of our personalities. That great region of activity within us of which we are not aware is the unconscious. A patient who could not recall a crucial incident in his life, Freud decided, had driven it from his conscious system, which permits of ready recall, into his unconscious. Freud called this process *repression*.

ID, EGO, AND SUPEREGO

In order to explain repression, Freud made use of three agents of the psyche, which he termed the *id*, the *ego*, and the *superego*. The *id* is the unconscious home of the instinctive impulses. It strives powerfully to find expression in some form, but by itself it is primitive and unorganized and

cannot determine the manner of its expression. As Freud describes it, the *id* is dominated by the *pleasure principle*, that force in the individual which attempts to secure immediate gratification of instinctive cravings.

The *ego*, the organized part of the psyche, guides the particular outlets of the forces of the *id*. The *ego* depends for its existence upon the perceptual system, by means of which we are conscious of the external world and of ourselves. This part of the psyche, according to Freud, is dominated by the *reality principle*; that is, it is guided by the knowledge it has of social precepts and future consequences of many kinds.

The *superego*, somewhat similar to the concept of conscience, is that part of the psyche which harbors ideals of conduct. These are the three players in Freud's drama of life, and the setting is one that spells battle. The *ego* is the buffer between forces of the *id* and the *superego*. It controls all forces that enter consciousness and that lead to action. It makes an attempt to remain peaceful and organized in the conflict between the *id* and the *superego*. The *ego* accounts for the repression of instinctive strivings in conformity with the dictates of the *superego*.

DISGUISED EXPRESSION OF REPRESSED IMPULSES

It would seem that the *ego* possesses power in its own right, if it can conquer an instinctive impulse by repressing it. Freud explains that what happens in connection with repressed impulses actually reveals weakness of the *ego*. The forces in the *id*, baffled by the *ego* in their attempts at expression, are not content to remain idle and defeated. They press for expression. This is a danger to the *ego*. When some repressed instinctive power seeks expression, the *ego* feels afraid but does not know of what it is afraid. Thus arises the feeling of anxiety, which seems meaningless or irrational but nonetheless real. Freud says that anxiety states are distress signals sent out by the *ego* to the all-powerful pleasure principle. The pleasure principle cooperates with the *ego* by leaving that particular impulse of the *id* as such under *ego*-repression, but forcing it out indirectly and symbolically in some queer behavior. The repressed process appears in a disguised way in the form of a neurotic symptom, and enjoys a gloating existence outside of the *ego*-organization.

In this connection, we may consider the case of

a person who has developed a compulsion to wash his hands. During the course of a day, he may repeat the act many times even though his hands are clean. He feels that he must wash his hands; he feels upset and disturbed if he attempts to keep from performing the act; and he feels a drop in tension when he carries it out. In Freudian interpretation, this act would be regarded as an indirect expression of some repressed impulse, direct expression of which would not be permitted by the ego. Repeated handwashing, on the other hand, is not forbidden behavior, even though the neurotic may perceive it as silly and irrational. Such disguised expression of the repressed impulse would relieve the ego from pressure by the id. The danger experienced by the ego and the accompanying anxiety would disappear for a time. With passage of time and subsequent mounting pressure for expression of the impulse again, response to the growing anxiety felt by the ego would result in repetition of the handwashing act.

DRIVING FORCES IN THE UNCONSCIOUS

It is apparent that much emphasis is placed by Freud upon driving forces submerged in the unconscious. Freud originally proposed two distinct tendencies in the id: sexual instincts and ego instincts. The latter primarily are the instincts of self-preservation. The sex instincts are always directed toward a particular object. When attachment to a certain object is repressed, the sexual impulse or *libido* transfers itself to another object. When Freud found that many individuals turned their love to themselves, he argued that the libido had then found its love object in the ego.

For this reason he could not find a conflict between the ego instincts and the sex instincts, since the ego instincts sometimes become servants of the libido. He then combined the instincts of self-preservation and species-preservation into the single concept of *Eros*. He did find, however, that there is an instinct separate from *Eros* and in opposition to it. He called this the death instinct. All impulses tending to destruction and hate fall into this category. Thus, the death instinct accounts for tendencies to suicide in some individuals and the torturing of a loved one in others.

INFANTILE SEXUALITY

All the time Freud was evolving these various concepts, he was using them in his work with neu-

rotic patients. His approach involved first of all the recall of the experiences that had been repressed. He applied many methods in his attempts to overcome the resistance of the ego to such recall. He had his patients talk for hours, over periods of time, limiting what they said to matters pertaining to their unhappiness. One procedure, for which Freud became famous, was his interpretation of dreams. During dream states, he thought, the repressed desires appeared in strange, symbolic guises. He also studied lapses of memory, slips of the tongue, and queer mistakes people made which they could not understand. Freud interpreted them as disguised expressions of a repressed force in the id.

By these methods, Freud frequently was successful in reviving an experience which he determined to his satisfaction was connected with the neurosis. However, one repressed experience when brought into consciousness gave evidence of another such experience farther back; and Freud had to continue his probing. He would usually wind up in experiences dating back to infancy.

Libido finds its earliest expression, according to Freud, through oral and anal stimulation. Later it moves outward and becomes attached to persons and objects. The persons involved, in this theory, are generally the parents of the child. Love of boy for mother, with accompanying feelings that his father is a rival, gives rise to the Oedipus complex. The boy realizes that he cannot become a substitute for his father to his mother, and a conflict ensues which results in repression. (In similar fashion, love of girl for father gives rise to what is termed the Electra complex.) Throughout infancy, all efforts at libido expression are met, first, with an outer and, second, with an inner resistance. These experiences Freud viewed as the original source of the trouble.

SUMMARY

Freudian psychology, concentrating on the relationship between conscious and unconscious processes, divides the psyche into three interacting entities: id, ego, and superego. The id is the unconscious part of the psyche and contains two warring instincts: the life instinct at one pole and the death instinct at the other. Dominated by the pleasure principle, it lacks the organization to determine the specific outlets for the impulses. Those outlets are primarily a function of the ego, which

depends for its existence upon the perceptual system and which is guided by knowledge of consequences. Growing out of the ego, because of early sexual repressions, is the superego, somewhat akin to conscience.

Other psychoanalytic theorists have introduced many modifications in Freudian theory. Many have felt, for example, that less weight should be given to inborn motivational forces and more weight to social influences on personality. Despite rejection of numerous aspects of this theory, his general ideas regarding the importance of motivational forces and unconscious influences on human life have had tremendous impact.

VIEW OF ORGANIZED EXPERIENCES

In Titchener's view of existential experience, our everyday world is reducible to three simple, ultimate existences: sensations, images, and affects. A group of German psychologists—most prominent among whom were Max Wertheimer, Wolfgang Köhler, Kurt Koffka, and Kurt Lewin—came to regard introspectively-analyzed sensations, images, and affects as artificial. We should study our experiences, they said, but we should recognize the natural patterns into which our experiences fall, and then we should determine the conditions under which the natural patterns appear.

Think for a moment of your experience of this page of print. You can analyze it into sensations of blackness, whiteness, pressure, and the like, if you are a good introspectionist. Nevertheless, before and after the analysis, your experience is an organized totality, for you then are not aware of elementary mental processes. You are experiencing a page of print in its entirety. A perception of *all* of it, as such, possesses for you a strong reality. This book we regard as something which does not depend upon us for its existence. We open it, close it, put it on the shelf, walk away from it, and it remains the same book to us.

OBJECTIVE AND SUBJECTIVE EXPERIENCE

Köhler called those experiences of the *all* of objects and events, which appear as actualities outside of us and independent of us, *objective experiences* (Köhler, 1947). There are other experiences that we do not refer to the outside, but that we regard as personal and inside. We have

experiences of muscular strain, emotions, and memories. They are our *subjective experiences*.

We can come to regard outside objects as experiences within us, as Titchener did; but Köhler reminds us that our ordinary experiences of things and movements have a strong and natural objectivity. The allness and externality of chairs, books, and even sounds have been present to us from early childhood. A case in point: A physicist tells of an experience of his five-year-old son, at the time of an earache. "Can't you hear that ringing sound?" the boy asked his father. It was difficult for the child to understand that the ringing came from processes in his ear and not from some external source, since sounds he had heard in the past could be heard by other people. It is still another step removed from naïve experience to regard sounds which can be heard by others, that is, external sounds, as processes inside one's head.

Instead of analyzing objective and subjective experiences into sensations, images, and affects, Köhler believes that the task of psychology is to study the patterning of all experiences. He saw an outstanding characteristic of experience in its organization into wholes. The view which emphasizes the organized wholes of our experience has been called the *gestalt* view. The nearest English words to *gestalt* are *configuration* and *pattern*, but they do not carry the precise meaning, so the word *gestalt* has become a part of our English psychological terminology.

THE WHOLE IS DIFFERENT FROM THE SUM OF ITS PARTS

Christian von Ehrenfels, an Austrian philosopher, was one of the men whose works form the background of the *gestalt* view. Von Ehrenfels was interested in music. The idea current at his time was that a melody was a sum total of the notes comprising it. He wondered why a melody played in one key remained the same when played in another key since, when transposed, the notes of the melody (and thus, the sensory parts) were all changed. The melody, he concluded, was a quality of the whole sequence. Von Ehrenfels' idea was that experiences had many qualities as a whole, and such qualities disappeared when those experiences were broken into parts. Likewise, he believed that, when we add together the parts of an experience, we do not arrive at whole-qualities.

The whole-qualities are independent of the parts, inasmuch as the parts may be changed and the whole-qualities still remain identical.

However, von Ehrenfels regarded the whole-qualities, such as melodies, as new elements added to the sensations of the notes making up the musical composition. We have both the sensory elements and the whole-qualities, which are added by thought processes. Köhler and other gestalt psychologists later came to the opposite conclusion that wholes are the primary and immediate sensory data and that elements, such as simple sensations, are products of abstract thought that come afterward. This view can be traced to the interpretations that Wertheimer gave to his famous experiments on perception of movement.

When you see motion pictures, there is no movement on the screen. If Rex Harrison seems to walk from a chair to a table, the pictures thrown on the screen in rapid succession to produce the action do not in themselves have that movement. They are merely still photographs of successive positions. Why, then, do we see movement? For experimental purposes, we can illustrate what happens by arranging a situation that involves two alternately flashing lights. There is no light in the space between them, but under stipulated conditions a brief flash of one followed by a flash of the other will appear as one light in motion. This is called the *phi phenomenon*. It is obvious that the movement cannot be described as two elementary sensations of light. The movement is not in the lights. According to gestalt theory, the movement involves the same organized brain processes that are occasioned if a light moves in space.

Wertheimer saw in this apparent movement a new principle in psychology. The phi phenomenon is an organized experience, divorced in nature from elementary sensations. The organization occurs because of dynamic brain processes, forces interacting with each other and forming unitary experiences. Wertheimer believed that what is true of the phi phenomenon is also characteristic of other varieties of experience.

ORGANIZATION BY THE NERVOUS SYSTEM

According to the gestalt conception, light waves striking the eye and sound waves striking the ear are not dynamically organized; and the same is the case with other forms of stimulation. It is the

nervous system that organizes segregated wholes in accord with the world of physical objects. Consider the fact that an object remains the same size to us, even though we change our distance from it. In order for you to see this book, there must be light reflected from it to your eyes. There is an image of it on your retina. If you hold it one foot or two feet away from your eyes, it appears to be the same-sized book. Nevertheless, on your retina it is twice as wide at one foot as at two feet. Although your experience of the book must come from that retinal stimulation, your perception of the size of the book does not correspond to it, but rather to the actuality in the outside world—the book measures the same whether it is one foot or two feet from your eye. It is possible to think that the book remains the same because the total organization in the brain remains the same, even though the sensory stimulation from the book is changed.

THE GESTALT FORMULA

Köhler elaborated the stimulus-response formula for psychology into *Constellation of stimuli* → *Organization* → *Reaction to the results of organization*. Thus far we have concentrated upon the first and second terms. The gestalt psychologists have contributed to numerous fields of psychology, including that of reaction and behavior. The behavior of another person is regarded as a segregated whole of the sensory field, primarily visual, in the objective experience of an observer. Köhler cites many examples in which there are similarities in organization of the subjective and objective experience of the same behavior. One instance he mentions is the behavior of a pianist playing a sonata. The organization of the sonata is present in the subjective experience of the pianist, such as a *crescendo* followed by a *ritardando*. The activity of his muscles in playing conforms to the organization. The resulting sound waves are grouped in the objective experience of a listener in a similar manner to the grouping in the subjective experience of the pianist. In *crescendo*, the subjective and objective experience of the behavior both have a whole-quality of *swelling*.

It is not implied that the precise elements in the subjective experience of another individual are revealed by behavior observation. Köhler is speak-

ing of the whole-qualities, which gestalt psychologists say can have varying or interchangeable elements.

INSIGHT IN PROBLEM SOLVING

The gestalt psychologists have found evidence for their view in numerous experiments on perception, learning, memory processes, and emotions. One of Köhler's famous studies on the mentality of apes is a sample of the experiments performed. The tests had many variations, but in one instance Köhler suspended a banana above the reach of the apes (Köhler, 1927). Nearby, but not directly under the banana, was a box. Six apes were placed in the room. At first they attempted the impossible task of reaching the banana by jumping. One of the apes ceased jumping and paced about the room. Suddenly he stopped next to the box and pushed it sufficiently near the banana so that, by a leap, he was able to grasp his reward. Only a few seconds after the ape stopped near the box, he had secured the banana. From his behavior, Köhler concluded that the ape had surveyed the situation as a whole. Suddenly he saw the connection between box, jumping, and banana; and the problem was solved. *Insight* is the term Köhler applies to an experience of the total field when a pattern appears in which certain parts are felt as dependent upon other parts.

RECAPITULATION

Gestalt psychology emphasizes the organized wholes of experience, which have properties not contained in the sum total of the parts. The nature of the parts is dependent upon the whole. The formula for psychology, according to Köhler, is Constellation of stimuli → Organization → Reaction to results of organization. Stimuli striking the sense organs are not organized dynamically into segregated wholes. Such organization takes place in the nervous system, which reconstructs the units of the physical world after their unitary nature has been lost temporarily en route. To a whole of experience there corresponds a functional whole in brain processes.

VIEWS EMPHASIZING METHODOLOGY

In subject-matter theory, the attempt is made to develop facts and laws pertaining to *what* we

study. In methodological theory, which is concerned with *how* we study, rules of procedure for experimentation and reasoning are made explicit. Grounds for acceptance of evidence are found in the rules of procedure.

The points of view so far considered were primarily attempts to lay out the subject-matter domain of psychology within the sciences. Since about 1930 extensions and revisions of each viewpoint have been developed that have emphasized methodological principles.

The intimate relationship of methodological theory to subject-matter theory has become more evident as the two have been more carefully separated and considered. What is studied is inevitably influenced by what is regarded as acceptable with respect to how studies are performed and how conclusions are drawn. The large subject-matter differences between existential psychology and behavioristic psychology are a case in point. Watson, the behaviorist, in his objections to the viewpoint of Titchener, the introspectionist, raised a methodological question. He rejected existential analysis of mental life as scientific evidence.

What were the grounds on which existential analysis was offered for scientific acceptance? The implication of the introspectionist was that what he reported about his mental processes was correct and unimpeachable. Yet reports of inner observations frequently were conflicting from one introspectionist to another; and in terms of introspective reports alone there was no way to resolve the difficulty. In one sense personal inner observations are not verifiable by others; that is, technically we cannot observe directly the mental processes of others. If observational evidence is restricted to what an individual reports verbally, his statements cannot be checked by other scientists. Consequently, the method of authority received overemphasis among introspectionists. An internal analysis of mental life tended to be judged correct or incorrect in terms of the psychologist who reported it.

OPERATIONAL DEFINITIONS

Harvard psychologists Boring and Stevens, taking a cue from Bridgman, approached the problem of reports of inner experience in terms of the methodology involved in the definition of perceptual terms (Boring, 1945; Stevens, 1935; Bridgman, 1945). In Titchenerian psychology, words

like "red" and "pitch" referred to conscious events. What do they mean in the experimental framework?

In a psychophysical experiment, traditional procedure was to hold constant all variables except one. The variables were physical, and the experimental conditions were observable and verifiable by any trained scientists. As an example, in a study of pitch discrimination, the experimental design required that all properties of the sound stimulus be held constant except frequency of vibration.

Stevens utilized as evidence of internal events the operation necessary for all counting and measurement in science, namely, discrimination. In a discrimination experiment the design requires a differential response by the participant. The only relevant cues available to the subject are presumed to be those of internal processes (which cannot be observed directly by the experimenter). The experimenter, on the other hand, is acquainted with the observable operations in systematically presenting stimuli to the participant. If the verbal reports are consistent with the variables manipulated by the experimenter (for instance, if the experimenter in a number of trials increases the vibrational frequency from 100 to 200 cycles per second and the observer consistently reports "pitch higher"), the experimenter may infer that the subject has separated one internal event from all the others. In such a situation his report of internal events would be verifiable. The relation of physical frequency of vibration and psychological pitch would be one of material equivalence. The term referring to internal processes (here, "pitch") would have the status of a construct defined in terms of experimental operations. Thus the verbal report by an observer of his internal processes does not have to stand on his authority alone.

TOLMAN'S PURPOSIVE BEHAVIORISM

Picking up the cue from the methodology of operational definitions also was Edward C. Tolman of the University of California. He attempted to bring purposes within the province of behaviorism (Tolman, 1932). Is it possible to define purposes (goals of an individual) in objective terms? In so doing, is it possible to avoid implication that a future event determines a present event?

Intervening Variables. Tolman's approach primarily was that of an animal psychologist. If a

white rat learns to run a maze in a specific, identifiable way there are many necessary conditions for the performance. Food in the box at the end of the maze, the shape of the alleys, and the like are examples. By removing or varying the conditions in degrees and noting change in the animal's performance, one can determine experimentally the necessary conditions. If the behavior is disrupted, there are grounds for inferring that the factors changed were necessary conditions for the identifiable performance.

By such utilization of experimental inference, Tolman proposed standard experiments by which variables within an individual could be defined. Internal variables that influence the response of a given organism to a given stimulus situation he called *intervening variables*. Among those he considered were demands, appetites, differentiations, motor skills, hypotheses, and biases. As an illustration, the standard operations for defining a demand would be somewhat as follows: The maintenance schedule (feeding times) would be the manipulated variable. Systematically varied would be time elapsing between eating a prescribed diet and the moment when a rat of a stipulated group is put into a standard maze. The only variation inferred to occur within the animal under these conditions would be variation in demand for food.

If a concept of purpose is to be admitted on objective grounds, we need evidence that an object or event related to a demand (a) was previously encountered at the conclusion of the behavior under investigation, (b) is not now present, and (c) is a necessary condition for the behavior. The object or event is a goal that will be encountered by the animal if he behaves in a certain way. If he does not behave in the prescribed manner, he will not reach it.

The purpose of an action cannot be admitted unless some kind of differential behavior has occurred. Therefore, it is apparent that demands producing forward-going behavior are not sufficient basis for interpretation.

Vicarious Trial and Error. To meet the requirement of differential behavior Tolman utilized the concept of vicarious trial and error at a choice point in a maze. A choice point is a part of a maze at which a turn in one direction is correct in terms of progress toward the goal and a turn in another direction puts the animal in a blind alley. Tolman had observed that, as white rats were learning to

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run a maze, they exhibited "lookings or running back and forth" upon approaching a choice point (Tolman, 1938). Muenzinger termed the behavior "vicarious trial and error" (Muenzinger, 1938).

An experiment in which vicarious trial and error would be an indicator of a goal as a necessary condition of maze performance might be designed as follows. A white rat is trained to run through a maze, learning to follow consistently a sequence of left and right turns at successive choice points. Whatever vicarious trial and error behaviors he exhibits at choice points are eliminated. The animal reaches the point where he performs without error, each time eating food at the end of the maze. It would be predicted that, on a subsequent trial, the animal would again perform correctly and without hesitation at any choice point. At this stage a change is introduced into the experiment. The food is removed, and the animal runs through the maze once more.

Now what would be predicted for the subsequent trial? If the goal (food for an animal with a demand for food) is not a necessary condition for the maze performance, then the animal will perform in the same manner as when the food was present. If the goal is necessary, the animal will change his performance, and it is presupposed that the change will be revealed through vicarious trial and error behavior at choice points. Upon the basis of experiments similar to the one just described, the latter would be predicted.

Such a prediction would imply a causal relationship between removal of food and vicarious trial and error; and we would run into trouble if we thought of the relationship as direct. If, however, we treat the removal of food as cause of a change within the animal (an intervening variable), we can think of the goal as a present state within the individual. If the goal as we observe it is changed, the correlated intervening variable is changed, and in turn the behavior is altered. Thus, purposes may be dealt with in objective terms and without implying that a future event determines a present event.

HULL'S BEHAVIOR SYSTEM

Clark Hull of Yale University formulated a theoretical system of behavior, starting from a small number of primary principles and definitions (Hull, 1943). From these he deduced according to logical rules a considerable number of corol-

laries and theorems. The corollaries and theorems, when correlated with experimental operations, are predictions of what will happen in an experiment if the theory is correct. They are put to the test of experiment; and if the theoretical predictions are verified, the theory is upheld. On the other hand, if the predictions are not verified, revision of the theory can be made. Numerous modifications were made by Hull during the years following the first formulation of the theory (Hull, 1951, 1952).

This procedure is called the *hypothetico-deductive method*. The propositions of the theory are regarded as hypothetical in the sense that they are continually under the controls of (a) logic and (b) experimental observations. From the set of hypothetical propositions, other propositions can be deduced. Hull's system aimed at quantitative precision and as such cannot be summarized in a few paragraphs. We can, however, get a general idea of the approach if we take a few liberties for our purposes.

Intervening variables played a key role in Hull's theorizing; and analysis of behavior in animal learning experiments was emphasized in deriving the principles of the theory. Consider a situation in which an animal is put into a box so constructed that, if a lever is pressed, a pellet of food is released into a food cup. When put into the box the first time, the animal typically goes through considerable activity before it presses the lever and gets a pellet of food. After this first experience it does not immediately press the lever again. Some irrelevant activity occurs before the second lever-pressing takes place. However, as time goes on, the irrelevant activity virtually disappears. The rat gets to the point where it presses the lever, eats the food, immediately presses the lever again, eats the food, and so on.

Habit Strength. In this kind of situation the animal experiences a number of times the conditions that Hull regarded essential for learning: (1) the occurrence at the same time of the trace of the stimulus within the organism and the response (here, lever pressing) and (2) reinforcement (here, the reduction of hunger stimuli through the obtaining of food). He postulated that each such experience resulted in increased tendency for the stimulus trace to evoke the response; and he spoke of this as an increase in *habit strength* of the response. He further postulated that the first such experience brought the greatest

increase in habit strength and that later trials added successively smaller increments to habit strength.

Habit strength is a theoretical construct. It cannot be observed directly. It is an intervening variable that is defined operationally on the antecedent (stimulus) side in terms of the number of trials with reinforcement.

Reaction Potential. Though habit strength influences responses, it is not the only factor affecting behavior. An animal with much experience in the lever-pressing box (and, thus, with great habit strength) might in some circumstances not press the lever at all—if, for example, it were satiated when put into the box. In another basic statement Hull introduced the intervening variable *drive*. Drive is related on the stimulus side to amount of deprivation; but there is not a one-to-one relationship between them. Up to a certain point, drive increases with increased deprivation. Beyond that point, it decreases. (An animal weakened by starvation would have less drive than one deprived of food for a shorter period of time.) Other intervening variables were introduced to account for observations that responses are influenced also by amount of reward (the intervening variable of *incentive motivation*) and intensity of the stimulus (the intervening variable of *stimulus intensity dynamism*). Thus, says Hull, the strength of tendency to make a given response (*reaction potential*, in his terms) is a product of habit strength, drive, incentive motivation, and stimulus intensity dynamism.

Inhibitory Potential. Furthermore, reaction potential does not function alone in determining response. A second set of intervening variables deals with inhibition of response. If, for example, an animal has responded many times with lever pressing, it may reach the point where fatigue from making the response will result in *inhibitory potential* greater than reaction potential and no response will occur. Even if inhibitory potential is not great enough to prevent response, it influences what the organism does. Thus we may think of net reaction potential (reaction potential as lessened by inhibitory potential) as the final intervening variable determining response.

Responses are observable; they can be measured in various ways. In Hull's system, these measurements are used to infer strength of net reaction potential. Thus, the shorter the latency of response,

the greater the net reaction potential; and the greater the amplitude of response, the greater the net reaction potential. Hull's system thus works from antecedent conditions (observable) through a chain of intervening variables to responses (observable).

LEWIN'S FIELD THEORY

Hull's system of behavior has been developed in terms of stimulus-response sequences and inferences of states such as drives and progressive aftereffects of previous stimulus-response sequences, including reinforcements. Many of the relationships studied have been those of successive events, pertaining both to (a) sections of a present S-R sequence, and (b) the dependence of one occurrence of an S-R sequence upon another, mediated by after-effects within an individual.

Life Space. Kurt Lewin's approach, while not challenging the correctness of the kind of successive relations examined by Hull, differs from the latter in that he provides for centering on the events which behaviorists would regard as a stimulus-response sequence. Where and what are the events immediately prior to and concurrent with the behavior of a person? They are located within the individual, and Lewin refers to them as the *life space* of a person at a given time (Lewin, 1936). The life space of a person is described in terms of the way in which the person himself and his present environment exist for him. What an individual does at any given time is dependent upon these central events; his momentary life space.

By definition, the life space is represented as those, and only those, events affecting behavior immediately following or concurrent with it. If there are any events within the individual upon which the behavior does not depend, they are not part of the life space. Also, by definition, the life space is represented as those, and only those, physical, social, and somatic processes which affect the internal events that in turn affect behavior.

Laying down such a rigid definition of life space does not mean that Lewin's system is not amenable to experimental testing. The definition simply controls what shall or shall not be represented in the life space of an individual. If, in a psychological experiment, it would be determined on the basis of experimental inference that an ob-

ject did not have influence upon the behavior of an individual, it would not be included in the description of life space. Should it be experimentally determined that the object did affect behavior, it would be included.

In his exposition of his theory, which he regarded as methodological, Lewin leaned heavily upon inference from behavior in a given situation (Lewin, 1951). If his statement that "what is real is what has effects" can be interpreted to mean that after behavior has occurred we infer back to the nature of life space, the grounds for such an inference would be a law or set of laws expressing a one-one causal relationship between the momentary state of the individual and the behavior under consideration. In turn, we would look for the grounds upon which the laws were established prior to the individual case subsumed under them.

Valences. An important concept in Lewin's theory is termed *valence*, a property of objects in the psychological environment (Lewin, 1935). An object that is agreeable to an individual and attracts him toward it is said to possess positive valence. One that is disagreeable and repels an individual is described as having negative valence for him. If neither of these conditions obtains, the individual is indifferent to the object. These definitions of valences are rigid. The empirical problem is the determination of which valence for an object, if any, holds in an individual case.

Lewin provided for such a determination without relying solely upon behavior as the basis of inference, which would assume a set of laws relating valences and behavior. He declared that the valences of environmental objects are correlative with the needs of an individual. An independent determination of the momentary state of the needs of an individual could provide the grounds for an inference pertaining to valence, if the following holds: (a) a need in an unsatisfied condition determines a positive valence for any object that would satisfy that need; (b) a need in a satisfied condition results in indifference to any object that would satisfy the need; and (c) a need in an oversatiated condition determines a negative valence for any object that would satisfy the need.

Topology and Vectors. Lewin made use of correlating definitions by means of which he related the concepts of life space of a person and spatial representations of those concepts. He developed a

system of drawing diagrams by which the relations of a person and objects in his psychological environment could be presented. Representations such as these are called topological.

In the diagram symbolizing life space the valence of objects was represented by a plus sign for positive valence and a minus sign for negative valence. According to Lewin's system, the valence of an object determines the direction of behavior. In representing the direction by an arrow, Lewin introduced the concept of a non-metrical vector, which he regarded as a psychical field force proceeding from an individual toward an object with positive valence. If an object possesses positive valence with sufficient strength in the setting of other psychical forces, the individual will act in accordance with the vector.

In life situations, the individual may encounter difficulties in attaining his goal. Such difficulties as exist for him are represented as barriers, lines drawn between the object with positive valence and the person. A barrier may be physical, such as a fence, or social, such as a prohibition by other people.

GUILFORD'S INFORMATIONAL VIEW

When information is fed to high-speed electronic computers, they are able to store it, use it for generating new information, and evaluate the consequences of their actions. These information-processing devices are capable of solving extremely complex problems. J. P. Guilford, of the University of Southern California, has proposed that living organisms be viewed as information-processing agents, functioning in ways analogous to (though not necessarily identical with) electronic computers. He believes that organisms are not just passive, touch-and-go mechanisms; and he feels that the stimulus-response model used by the behaviorists, though applied successfully over a large range of behavior, has failed to account for such complex processes as human thinking (Guilford, 1962).

Factor Analysis. Guilford's view was developed from application of the logic and operations of factor analysis in studying the nature of intelligence. Such work has led to the conclusion that intelligence is not a single ability, leading a person to perform at about the same level on all kinds of tasks. An individual may be better at one kind of task (say, items requiring understanding

verbal relations) than at another (for example, performing simple computations). How many different kinds of ability are there? What is their nature? *Factor analysis*, a statistical procedure for investigating co-variation in items of response information, can be used to obtain answers to these questions.

The first step involves giving to a sizable group of subjects a number of tests constructed so that items within each are highly similar and so that there are differences between tests. The scores for each person on all tests are obtained, and statistical procedures are applied to determine how these scores are related. In some instances, the performance of persons on several tests tends to be similar. If subjects do well on one, they tend to do well on certain others. If they do poorly on the one, they tend to do poorly on the other tests also. The factor analyst makes the inference that performance tends to be relatively consistent on these tests because there is an underlying ability common to all the tests in the group. The tests and test results are then studied to determine what is common to those in the group and lacking in those that do not show similar consistency of performance. The nature of the underlying ability is inferred from observable common features.

Traditional psychological studies follow the design principle of holding all variables constant except one, varying that one in known ways, and observing what happens to the response as the stimulus is varied. Emphasis is on the study of S-R relationships. In contrast, factor analysis emphasizes the study of relationships between responses, using these as guides for inferring underlying traits within individuals.

Structure of Intellect. On the basis of such work, approximately sixty separate intellectual abilities have been differentiated and defined. Efforts to classify such abilities led Guilford to propose a model, known as the *structure of intellect*, in which abilities are pictured as varying with respect to (1) contents—the kind of information involved in the task, with four varieties represented in the model; (2) products—forms in which information is cast, with six varieties; and (3) operations performed on the information, with five varieties. A task involving the perception of a single object would involve the ability of cognition (operation) of figural (content) units (prod-

uct). A task calling for recall of the relationship between the meanings of two words would call for the ability of memory (operation) of semantic (content) relationships (product). With four kinds of content, six kinds of product, and five operations, 120 different combinations of the three are possible. In terms of the model, thus, it would be predicted that there are 120 differentiable intellectual abilities.

From the standpoint of methodology, it is of interest to note that, when the model was first conceived, it was based on empirical evidence of some forty abilities. Since that time, factor analytic evidence has been obtained for approximately twenty additional factors predicted by the model. Abilities suggested by the model but as yet unconfirmed in test studies provide leads to the construction of new types of test.

Guilford makes the point that the most significant aspect of the structure of intellect for psychological theory is its emphasis on the importance of information in intellectual abilities and its support for conceiving the living organism as an information-processing agent (Guilford, 1960). Dealing with various kinds of information presented in various ways, the organism performs the same basic kinds of operation as the electronic computer. Many traditional concepts in psychology can be interpreted anew by use of this model. Consider, for example, the concept of reinforcement, mentioned previously in connection with Hullian theory. From an information point of view, when lever pressing is followed by the obtaining of food, the organism receives information that pertains to the outcome of the action. Using it as a basis for assessing the action is the operation of evaluation. Feelings of satisfaction and of pleasure and pain may be treated as information concerning the state of affairs of the organism. Thus, Guilford feels, the information view can deal with emotions and motives as well as the cognitive aspects of mental life, fitting them all into a single scheme.

VIEW OF THE SELF

Except for the psychoanalytic approach, the points of view described so far have involved attempts to organize and characterize psychology as a whole. For example, although many topics included in present-day psychology were not cov-

he exists in the present, trying to help him to understand better what he is like and to make it possible for him to change facets of his personality that are related to his unhappiness and disturbance. The therapist provides a supportive and permissive atmosphere but refrains from directing the therapy in the sense of interpreting for the patient the significance of his actions and statements. It is the client rather than the therapist who makes interpretations and initiates changes. Implicit in the approach is the idea that what an individual reports about himself does provide valuable information; unconscious factors do not so influence what a person says that one must dig far below the surface to determine what his statements mean.

Rogers' theory was developed on the basis of his experiences with client-centered therapy. He found that emphasis on the concept of self helped to give order and meaning to what happened in the therapeutic sessions. Like other theorists, he does not regard his theory as a finished product. As new developments occur and it becomes clear that a theory does not adequately cover some aspects of behavior, modifications are sought.

CONCLUDING WORD

Psychologists like Hull have been careful not to let their theories run too far ahead of experimental evidence now available. Scientists do not claim to treat all the problems of their fields, however demarked. One has to make a decision between (a) leaning toward a rigorous, quantitative but at present relatively restricted system of behavior and (b) being satisfied with a less rigorous, more qualitative and perhaps more dramatic development of the concepts of psychology. In one sense the latter sets the problems for the former, more conservative approach. Psychologists who are eclectic, or who subscribe to a dialectical experimental approach, are inclined to compromise these extremes. Most psychologists probably have more confidence in the conservative approach for the long run and still they believe that the demands of society upon psychology should be recognized by action with the best means at our disposal now. The psychology student of today, if he is continually guided by the research point of view, devoting his efforts toward the sharpening of concepts and toward greater precision in his

methods, accepts the challenge of many unsolved problems of behavior.

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PART II: General Fields

CHAPTER 3

Experimental Psychology

The goal of all science is to understand and explain the universe in which man finds himself and the events that confront him there. Many people other than scientists have a similar goal. What differentiates the scientist from those other individuals is that the scientist strives to develop an objective set of empirical rules according to which he pursues his quest for explanatory knowledge. The rules place particular importance upon the requirement that the ideas developed be capable of ultimate proof or disproof through observation. Proof or disproof could occur, of course, in a "just talk" situation or in what logicians would call a purely formal system where all that is required is internal consistency of ideas. But proof for the scientist requires more than internal consistency of ideas. It requires some form of specified objective relationship to the world of observable events or to the verifiable experiences of man.

Well-trained scientists are surprisingly alike in the way in which they pursue scientific knowledge. The major differences occur because not all persons are interested in the same types of events and phenomena. This is a fortunate state of affairs. Not only does it provide a broader coverage of events which man is able to explain but it also results in slight modifications of methodology unique to particular areas of investigation. These modifications contribute eventually to refinement of the general scientific method of research.

Those investigators about whom this writing is concerned are characterized by the choice of certain phenomena to study—those involving the behavior of living organisms. If we visualize the totality of science as a complex interrelationship of concepts held together by formal systems of communication, we find behavioral scientists occupying one segment of content with a set of concepts largely their own and with a set of techniques that have evolved from observations of their own class of variations (i.e., behavioral variations).

At the same time, however, we find psychologists required to keep their concepts and theories consistent with those of other interested groups of

BY WILLIAM W. GRINGS

scientists. For example, any behavioral relationship which can be shown to be incompatible with a relationship in physics or physiology throws both relationships into doubt, i.e., challenges scientists to account for the discrepancy. This illustrates how immediately and inescapably the basic methodologies of the different areas are brought together. Scientists must adhere to at least equivalent rules and regulations as to when they hold or discard a postulated relationship.

The behavioral scientist, with concepts somewhat unique to his discipline, is continually interrelating his conclusions with those of other groups of scientists employing somewhat different concepts. He is striving for a universe of discourse with which he can evaluate his own concepts and integrate them with the concepts developed by the other scientists. Further, it is at no time possible to divorce completely the methods of the scientist from the scientist himself with all of his personal motives. In the material that follows, particular emphasis will be placed upon certain methods of science rather than others. The *experimental* method will be stressed.

THE NATURE OF A PSYCHOLOGICAL EXPERIMENT

Since emphasis will be upon the particular type of scientific investigation referred to as "experimentation," let us turn first to the question "What is an experiment?" Let us center our attention on the psychological experiment. Most persons have a notion of psychological experimentation which involves bringing a research problem into a laboratory where all of the conditions are set by the experimenter and where instruments for carefully introducing changes in conditions are present. The investigator asks the question "Under this known set of conditions, how do the variables in which we are interested behave?" Such a laboratory model may be undesirably restrictive in some of the behavioral sciences where it is necessary to retain elements of realism that can be achieved only under extended observational circumstances. Instead of describing the more rigid model of a laboratory experiment, we will substitute a set of criteria which distinguish the experiment from other forms of research, quite independently of the place where the research is conducted.

An experiment is an empirical test of a proposi-

tion. The proposition is a statement of a relation between events. More specifically, the proposition is the assertion of the state of affairs believed to exist, with the assertion made in terms of some language. Rules for the analysis of propositions, as such, form an important segment of the subject matter of logic.

The proposition which is evaluated through observation of events in an experiment is termed the *experimental hypothesis*. Just how this hypothesis is arrived at, the manner in which it is stated or formulated, and the role which it plays in the process of experimental inference are important topics in the study of experimental methodology.

In most cases the experimental hypothesis is a statement of a relation among concepts. Each concept or term in the hypothesis denotes a determinate experimental (observational) procedure. In other words, the terms in the experimental hypothesis must be capable of operational definition. In statements involving aspects of quantity such definitions are expressed in terms of operations of measurement. Efforts to simplify, organize, and interrelate concepts have most frequently led to expression of the concepts in the form of variables.

Thus, the common model of the experiment incorporates two or more concepts in a dependent relationship which is the experimental hypothesis. The two classes of variables in the hypothesis are referred to, for convenience, as the independent and the dependent variables. Historically, the use of the terms independent and dependent arose in discussions of cause and effect and quantitative determination. The observed variation (in the dependent variable) was viewed as determined by or attributable to the experimental (independent) variation. In the evaluation of many forms of relations among concepts these connotations of cause and effect introduce confusion to the analysis of the experimental hypothesis. In spite of this, the terms dependent variable and independent variable find quite universal use in descriptive statements of hypotheses.

A common expression for the experimental hypothesis is simply "The dependent variable (Y) is in some way determined by, or is a function of, the independent variable (X)." This statement carries with it the implication that other variables upon which Y depends are not operating in the situation, with the result that any changes that

are observed in Y may be attributed to the experimental manipulations of X. In other words, a simple statement of an experimental hypothesis implies that all other relevant variables are controlled in order that the relationship between the independent and dependent variable can be seen clearly, i.e., without being "mixed up" or confused with other effects. A common form of diagrammatic representation of an experiment is given in Fig. 3-1.

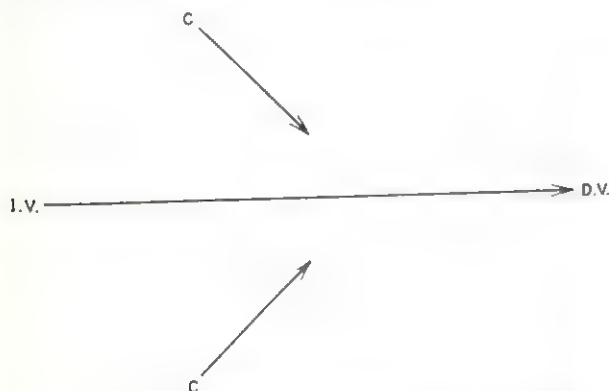


Fig. 3-1 Diagrammatic representation of an experiment showing the independent variable (I.V.), the dependent variable (D.V.), and extraneous control variables (C).

The test of the proposition, or experimental hypothesis, requires the use of conventional rules for acceptance or rejection of the posited relation in light of empirical evidence. Since the hypothesis is an empirical proposition these may be termed rules for evaluating empirical propositions. When applied to an experiment, the rules for proof or disproof of experimental propositions become the rules of experimental inference. At the present time the most common basis of experimental inference is statistical inference. It becomes possible to apply specific probability statements to describe the likelihood that the hypothesis is true or is not true. A judgment is made as to whether, if the hypothesis were untrue, the events which were observed might have occurred by chance alone. That is to say, it becomes possible to translate the experimental hypothesis into a statistical hypothesis which can be accepted or rejected according to the logic of statistics. Statistical hypotheses are stated in such a way that they cover all possible outcomes of the experiment. Thus, probability statements can be made for comparing the likelihood of different outcomes.

THE DESIGN OF AN EXPERIMENT

The criteria described above give the essence of the experiment, rather than the details involved in the actual planning of an experiment. Such a plan, or experimental design, typically contains at least four major considerations: (1) an analysis of the problem; (2) the formulation and statement of the hypothesis; (3) provisions for adequate test of the hypothesis (specification of controls, etc.); (4) considerations relating to experimental inference.

In the discussion which follows, a brief outline will be made of each of these phases of experimental design. Then, examples will be considered which have been selected to represent some of the broad aspects of psychological experimentation.

One of the first questions that becomes evident in a research situation is "Why was the research undertaken?" Research problems are so named because they are truly problems which the investigator is motivated to solve. The origin of research can best be understood when it is considered in terms of the goal of the man conducting the work, because people engage in research, as they engage in any other activity, in response to specific motivating factors. The predominant motivating factor in experimentation is to evaluate a possible answer to a question—to try to demonstrate that an empirical statement is true or false. In the field of experimental psychology it is possible to classify researches arbitrarily according to the origin of the problem.

PROBLEM ORIGINS

Meeting a Practical Need. First and perhaps most self-evident as a motivation for research is the solution of some practical need. Consideration of a few titles of recently published studies will illustrate this. The title "Type of mailing and effectiveness of direct mail advertising" (Cozan, 1960) suggests the practical task of getting people to read advertising material mailed to them. This is a behavioral problem, and the implication is that people will show different behavior to first-class mail advertising than they will to third-class or what is often called "junk" mail. Since at the time of the study there appeared to be no experimental evidence in support of the hypothesis, Cozan undertook an experiment comparing the

effectiveness of first and third class in a direct mail advertising campaign.

A second example, "Effects of surface friction on skilled performance with bare and gloved hands" (Groth & Lyman, 1958) begins with the introductory statement "It is common knowledge that circumstances of environment such as temperature or harmful chemicals may require that protective hand coverings be worn while skilled manual tasks are performed. Although the available literature in the field is not large, there seems to be general agreement that all gloves, even the thinnest surgeon's gloves, lead to some measurable performance decrement" (p. 273). The implications for experimental test of various relations of skilled performance and hand covering are apparent, with direct significance in practical working situations.

Not all problems oriented toward practical matters are so directly applied in their initial approaches. Many experiments are oriented toward more general principles with a view to eventually applying results to practical issues. Special journals have been developed which cater to the more practical research endeavor. A notable example is the *Journal of Applied Psychology*, a publication of the American Psychological Association.

Systematic Manipulation of Observational Parameters. A second class of problem results from efforts at systematizing observations and descriptions. Many workers are stimulated to describe and portray accurately the events and conditions in their area of interest. This leads them to concentrate upon observation of certain events to note the extent to which they vary together or show dependent relationships. Frequently, such investigators are motivated to classify behavior and to reduce descriptions of behavior by generating more inclusive concepts. Generally, their task is to make precise definitions of events and to observe relations among those events in a highly controlled systematic fashion. This type of scientist behavior is, of course, present with all forms of research problems. What characterizes the present group of investigators, however, is a tendency to make observations without an elaborate deductive system. They do not emphasize the role of theory in formulation of their problem. Instead they emphasize simply the observation of the variables to detect and organize dependent relationships.

An example of this type would be the study of Maltzman and co-workers (1958) entitled "The facilitation of problem solving by prior exposure to uncommon responses." The experiment proceeded from related work of Guilford (1950) who suggested that the frequency of uncommon but relevant (creative) responses may be employed as one of several objective measures of originality. It was also suggested that originality measured in this fashion may be related to the ability to solve "insight" problems. The principal purpose of the experiment was to determine whether such a relationship between originality training and ability to solve "insight" problems would exist.

A second example might be the study entitled "Retention and meaningfulness of materials" (Dowling & Braun, 1957) where the concern was for the description of determiners of ability to retain learned verbal materials. The relationship between retention of such material and the degree of meaningfulness of the words was at issue. The general belief was that the more meaningful the material, the better the retention. The specific implication being tested was that the relationship between retention and meaningfulness of the material may be dependent upon the method by which retention is measured (e.g., aided recall, unaided recall, relearning, or reconstruction).

Physiological and Comparative Relationships. Next, note will be made of studies which are very similar to the one described above, but differ in one important characteristic—they involve relations between behavioral and physiological variables (physiological psychology) and examine the degree of generality of laws among different species of organisms (comparative psychology). Frequently the research concerns physiological bases for psychological phenomena, and the experiments involve tests of the correlation between physiological or anatomical variables and psychological ones. Another example involves the effect of a drug upon behavior. An instance combining several of these features is indicated by the title "The effect of telencephalic injuries on learning by Paradise fish" (Warren, 1961).

Again the extent of interest in this type of problem is demonstrated by the existence of a *Journal of Comparative and Physiological Psychology*. In one recent issue the following evocative titles occurred in near succession: "Olfactory discrimination after temporal lobe lesions in mon-

keys"; "Comparison of phenobarbital and pento-barbital actions upon water ingestion"; and "Conditioning in pigs as a function of the interval between CS and UCS."

Tests of Theories. The problems mentioned above did not arise from attempts to prove or disprove a general theory of behavior. Many experiments, however, do have their origin in efforts to test specific deductions from such theories. In the sense that the term is used here, theory refers to an integrated set of ideas or propositions about certain phases of the behavior domain. Usually there are several central or basic concepts and relations from which more specific relations proceed logically. Many of the propositions making up the theory may be considered to be verified by experimental tests and to be empirical laws within the system. Many others arise as deductions from the more general propositions or as implications of the theory. These can be tested and become the basis of experiments.

An interesting example, which emphasizes the role of deduction in problem analysis, is contained in the "behavior system" of Hull (1951). One of his most general propositions was that responding at any moment is determined by two classes of concepts or variables: excitatory ones and inhibitory ones. Within each class subvariables were defined and given operational meaning. One of the inhibitory variables was labelled "inhibitory potential" (I_R) and one of the properties of this variable was spelled out in the following manner:

Whenever a reaction (R) is evoked from an organism there is left an increment of primary negative drive (I_R) which inhibits to a degree according to its magnitude the reaction potential (E) to that response (p. 74).

With the passage of time since its formation, I_R spontaneously dissipates approximately as a simple decay function of the time (t) elapsed (p. 74).

If responses (R) occur in close succession without further reinforcement, the successive increments of inhibition to this response summate . . . (p. 75).

Consider carefully how this one assumed property of an inhibitory factor dissipating with the passage of time could lead to predictions like the following: (1) A person should learn faster by spaced than by massed practice, because in spaced practice, time is provided for dissipation of in-

hibition between trials whereas in massed practice the inhibition accumulates. (2) Or, if unlearning (extinction) results from an accumulation of inhibitory factors, a learned response should extinguish faster by massed than by spaced extinction trials. Further, after a rest the extinguished response should recover much of its strength (the phenomenon termed "spontaneous recovery"). A long list of deductions from this single postulate could be stated, and many have served as experimental hypotheses in past investigations.

Models. Still another class of experiments originates from a basis very similar to a conceptual theory yet different in certain important particulars. The source is a model rather than a theory. Frequently it is possible to devise a physical or electrical analogy for some phenomena of psychological interest, and it is this analogy which is termed a model. While a model is set up quite independently of observed events (in the sense that the model does not logically require that its terms be tied to observables) efforts may be made, eventually, to apply predictions from the model to predictions about real world events.

A very popular form of model in present day psychology is that based upon probability or other systems of mathematics. Those relating to learning are discussed by Hilgard (1956) and have been the subject of several books (e.g., Bush & Mosteller, 1955). An example of a physical model would be that of von Bekesy (1960) related to explanations of hearing phenomena.

An interesting and informative discussion of the conceptual basis for experimental problems was published by Boring (1953) under the title of "The role of theory in experimental psychology." He lists what he calls different "levels" of theory from "theories resting on rationalized support" and "theories that can't be tested" through "physiological theories," "conceptual theories," and "mathematical and mechanical models." Many of the motives for problem development are evident from his summary, and all are couched in a somewhat historical context.

PROBLEM ANALYSIS

It is possible to differentiate the general problem from specific experiments designed to test some specific aspect of the problem. Of particular importance in this respect is an evaluation of the problem development in terms of the concepts in-

volved. Generally, concepts will be employed on different levels which vary in generality, from broad general concepts to quite specific notions. More general concepts are likely to be expressed in nonoperational terms whereas specific concepts are likely to be defined in empirical (operational) language. Concepts will be introduced in outlining explanations or avenues of approach to the hypothesis. Good problem development traces such explanations very carefully.

There might be two or more lines or avenues of conceptual development leading to the same experimental question or hypothesis. This is another way of expressing the fact that there may be more than one explanation for a given empirical event. These are termed alternate explanations of the experimental event. One explanation would proceed from one theory with its own concepts and theory language—the other explanation would proceed from quite different origins and assumptions. Experimenters sometimes become intent on “proving” that their explanation is “the” correct one and they strive to design crucial experiments. These are experimental hypotheses where the different theories or systems of concepts lead to different outcomes of the same observed events.

When a final course of preferred explanation is selected, the presuppositions and successive assumptions which lead to a precise statement of the experimental hypothesis will be readily in evidence. It will be possible to identify the major presuppositions as well as tell the basis for assuming the validity of the presuppositions.

Generally speaking, then, considerations pertaining to problem analysis range from preliminary ones concerning why the problem was undertaken, to tracing the logical route to the core of the problem and outlining carefully all presuppositions and assumptions that are made in developing the problem.

The major product of the type of problem analysis which we have mentioned so far is a distinct experimental statement or question which is to be the central issue of the research. It is called the experimental hypothesis and embodies an expressed relation among concepts. In earlier discussions it was noted that there are two classes of concepts, typically expressed in the form of variables and identified with respect to whether they are the determined variation or are the variations manipulated by the experimenter. The experi-

mental hypothesis then is a proposition which expresses a relation between a concept representing the class of dependent variables and a concept representing the class of independent variables.

The experimental hypothesis during the course of a research design will normally be expressed in several forms. Three forms are common: a general nonoperational statement, a specific operational level of expression and a statistical inferential form of the hypothesis. One statement of the experimental hypothesis may express the relation between independent and dependent variables in general terms where the concepts are not observable or are not directly indicative of the denotable events. An example of this would be the statement that learning is a function of drive. Here the independent variable, drive, presumably influences the dependent variable, learning, yet neither term as it stands is in observable (operational) form. The operational statement of the same hypothesis might be “the number of conditioned responses after a certain number of paired conditioning trials is a function of the intensity of the unconditioned stimulus” where the relation of intensity of the unconditioned stimulus and a more general concept “drive” has been assumed. Still a third form of expression for the experimental hypothesis is introduced at the time that results are evaluated from the standpoint of experimental inference. If statistics are to be used, a statement of the experimental hypothesis must meet the requirements of the statistical model to be employed. That statement will use terms from descriptive statistics arranged so that a probability statement of some sort can eventually be applied directly to the hypothesis.

EXPERIMENTAL TEST

Once the experimental hypothesis has been satisfactorily expressed, it becomes necessary to devise some logical arrangement of observations to employ as the empirical test of the hypothesis. In other words, it is necessary to establish a context which demands the conditions of the hypothesis. The events or conditions must prove or disprove propositions as stated in the experimental hypothesis.

Here the problem of relevant variables becomes very important because the events required by the hypothesis must be observed in an unambiguous way. Should the predicted events occur, one must

be able to attribute the events or the changes in the dependent variable to the effects produced by the experimental variation. It becomes necessary to control all other factors in the situation which could in some way confuse or confound the relation between the variables being observed.

Control of extraneous variation to avoid confounding of experiments is an important topic in experimental design and is discussed at length in textbooks on experimental psychology (e.g., McGuigan, 1960). One such book (Underwood, 1957) has two chapters devoted exclusively to illustrations of experiments where failure to provide appropriate controls severely weakened the experiments.

A discussion of methods of control is beyond the scope of this chapter. However, brief note may be taken of four of the types in common use: (1) holding the extraneous variable constant; (2) randomizing the effects of the extraneous variable; (3) balancing or equating the effects of the extraneous factor; and (4) performing statistical adjustments to correct for extraneous variation.

The influence of an extraneous variable upon a dependent variable can be controlled by holding the former at a single value, thus eliminating it in the sense that it is held constant and (unlike the independent variable) does not change. Hence, it cannot produce an effect on the dependent variable. The procedure imposes critical difficulties associated with *which* value of an extraneous variable to choose as the constant value.

When the extraneous factors are permitted to operate at different levels or values, no setting or value of the independent variable should be favored or hindered by the presence of the control variable. Values of the control variable can be assigned to settings of the experimental variable classes by a chance process, or by randomization, i.e., distributing the effects of the factors randomly. At other times, purposeful manipulation of the extraneous variable may be undertaken to balance out the influences of the undesired variation, or to equate the experimental variable classes on the control factor so that the undesired factor is not favoring any one setting of the experimental condition.

While statistical adjustment to eliminate an extraneous factor in an experiment may get somewhat complicated in practice, it is generally simple in principle. The influence of the extraneous vari-

able on the dependent variable is estimated, and the effect is somehow "subtracted" out to permit study of a "net" influence of the independent variable.

INFERENTIAL CONSIDERATIONS

Because the statistical inferential process is likely to place rather specific requirements on the collection of data, it is essential to plan the nature of the inferential process before one begins to gather observational information. Therefore, the experimental hypothesis must be stated in statistical inferential terms.

The scientist must decide which types of descriptive statistics are desired and which statistical model is most suitable to evaluate the data obtained from the observations. Usually a choice exists between (1) types of description which will best embody the intent of the hypothesis and (2) the type of probabilistic model which will best embody the descriptive terms that are used. Any probability model places restrictions upon the conclusions that can be drawn with reference to the experimental hypothesis.

Most commonly the statistical hypothesis is expressed in some form that can be evaluated by a probability logic and accepted or rejected on that basis. A null, or chance, hypothesis may be used which expresses the state of affairs which would obtain if the experimental hypothesis were not true. Then, if it can be shown that the observed event is unlikely to occur as a result of "chance," the "null" hypothesis is rejected, and its alternate—the experimental hypothesis—is accepted. The probability statement expressing the likelihood of being wrong in rejecting the null hypothesis (i.e., the probability that the null hypothesis is true and the observed results would have occurred by chance) is termed the *significance level*.

It will not be possible here to consider in depth the nature of the experimental-statistical inferential process. Fortunately, the student of experimental methodology has a wealth of specialized reference materials on this phase of the experimental process (e.g., Winer, 1962).

ILLUSTRATIVE EXPERIMENTS

Up to this point, attention has been focused on the experimental process, or method, without much concern for psychological content. We will now

turn to a few selected examples in the context of subject-matter areas. Space will permit only four chosen instances, and even then will not permit attention to details of design. For such details the interested reader is referred to the original reports and to the *Journal of Experimental Psychology*, a monthly publication limited to experimental behavioral research. In the examples that follow, emphasis will be placed upon the nature of the experimental problem rather than upon technical aspects of procedure, or details of statistical inference.

The particular studies illustrating a given area of experimental research were chosen with a double aim. Each investigation demonstrates some aspect of a subject matter area. In addition, each example has some special feature or methodological uniqueness by which the work has become well-known; published commentaries about these investigations are available to the interested reader. The first area, motivation and emotion, is represented by a series of studies on the learning of fear motivation. One of the interesting features of these studies is a clear origin in theory. The reader can readily trace the assumptions of the investigators as they proceed from a general problem to specific experimental designs to test hypotheses deduced from the more general assumptions.

The second illustration, from the field of perception, was again chosen for unique features. First, it involves a "popular" problem, that is, one that has been widely discussed in the public press. But more significantly, it illustrates the importance of control in experimental research, and the extent to which results obtained may be due to factors other than those assumed to be operating. The third example demonstrates the close relation between the experimental fields of biology and psychology; whereas the fourth example ties in experimental psychology with the study of broad issues of social significance. The last example also provides an opportunity to compare the experimental method with the survey method in the study of social problems.

MOTIVATION AND LEARNING

A little background for the total problem may be helpful. To begin with, everyone accepts the notion that both animals and man have what we call motives. Further, we assume some of these

motives are learned. There is probably no more pervasive concept in psychology than the concept of motivation. Yet, when we look carefully at the concept we find that it is a very complex one. Consider, for a moment, some of the ways we infer the existence of motive.

One approach employs the subconcept "need," because it seems self-evident that organisms are striving to meet their "needs." We note immediately, however, that need has no physical existence. It is entirely an inferred notion. Need has no meaning except in terms of a stated or implied goal. For example, the automobile needs gasoline in order to run, and the human needs food in order to live. Much of the concept of need, then arises through an implied relation to other concepts, such as the concept of life, or of health, or of well-being.

But is this the most apparent basis of the concept of motivation? Probably not. Many need states get their meaning from higher order constructs like "homeostasis." One may strive for denotative meaning by measurement of intra-organismic excitements, physiological imbalances, or biochemical deficiencies. These situations, too, are full of paradoxes. For example, a deficiency of oxygen (hypoxia) does not lead to behavior in the direction of relieving the deficiency but rather to a feeling of well-being. Eventually we take the complex conceptual matter to human goals and behaviors which appear to be far from the basic biological questions. To do this we have to get our drive or motivation concept tied in with other concepts like learning, because human behavior appears to be dominated by learned or acquired tendencies to react.

The present experimental approach originates with a postulated relation between motivation and learning, to the effect that habit formation (learning) occurs only in the presence of reinforcement. And reinforcement is defined in terms of a reduction in drive or need. In the particular example the learning of a fear drive is at issue. The logic of the problem development goes somewhat as follows: we assume (1) fear has drive or motive properties; (2) drive reduction is necessary for learning; (3) presenting laboratory animals (rats) with certain paired stimuli (electric shock and an environmental cue like white light) will lead to fear arousal accompanying presentation of the cue

alone; and (4) escape from the fear-arousal stimulus leads to drive reduction. If (5) it can be demonstrated that learning has been reinforced by escape from the fear cue, we can conclude that the environmental cue has developed motivational properties. This line of reasoning can be seen in the experiment by Miller (1948).

Note the apparatus in Fig. 3-2, which contains

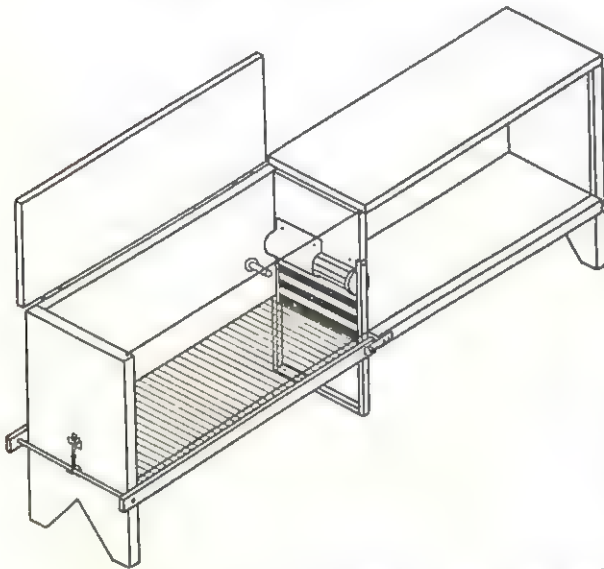


Fig. 3-2 Apparatus used by Miller to study acquired drive. (From Miller, 1948.)

two compartments separated by a partition the lower part of which is a door painted with white and black stripes. Above the door is a small treadmill and to the side is a bar projecting from the wall. One of the compartments is white with a wire grid as a floor while the other is black with a smooth floor. The door between the compartments can be opened by operation of the treadmill, the pressing of the bar, or at the external control of the experimenter. The task to be learned eventually by the animals (white rats) is to open the door to go from the left to the right hand chambers.

Several groups of animals were studied, one as an experimental group, the others as control groups. The experimental group was subjected to experience in the white box with an electric shock delivered through the wire floor. Since the door was open during these trials the animals could escape into the dark compartment. Training in

this manner was assumed to develop in the experimental animal a learned fear or anticipation of shock in the left compartment. The control groups were given similar experience in the apparatus but without being shocked.

From this point on no more shocks were used. The animals were introduced into the left compartment with the door closed and the task was for the animals to learn to open the door by operating the treadmill (or in another condition, to press the bar). Under these circumstances the experimental group of animals showed a gradual learning curve for "escaping from the white compartment" (Fig. 3-3) by rotating the treadmill, whereas the control animals did not show such learning.

The interpretation of this experiment, then, is that the stimuli of the white compartment acquire a fear drive property due to association with electric shock. This fear comes to exist in the white compartment even when the shock is not turned on. Escape from the white compartment into the black one leads to drive reduction (reduction in fear). The learning of the door-opening behavior by the fear-motivated animals is made possible by the reinforcing properties of this drive reduction (i.e., removal of the cues to fear). In other words, fear is *learnable* because it was learned as a response to previously neutral cues; it is called a *drive* because it motivated the learning and performance of new responses in the same way as other drives, like hunger and thirst.

The description of this experiment has been much over-simplified. Many interesting issues of experimental design are involved and have been discussed in considerable detail elsewhere. For example, Brown and Jacobs (1949) have pointed out that the drive attributed to fear in the foregoing experiment might have been caused by tension created by the conflict and frustration produced when the door prevented the animals from running. Their study sought to separate the effects of fear and frustration. The interested reader will find an extensive experimental literature originating and extending upon Miller's logic of learned fear as a reinforcer of new behavior.

Another approach to the same problem of demonstrating that learned fear has motivational properties is very similar but begins with a quite different initial premise. Brown, Kalish and Farber (1951) propose an experiment the logic of which

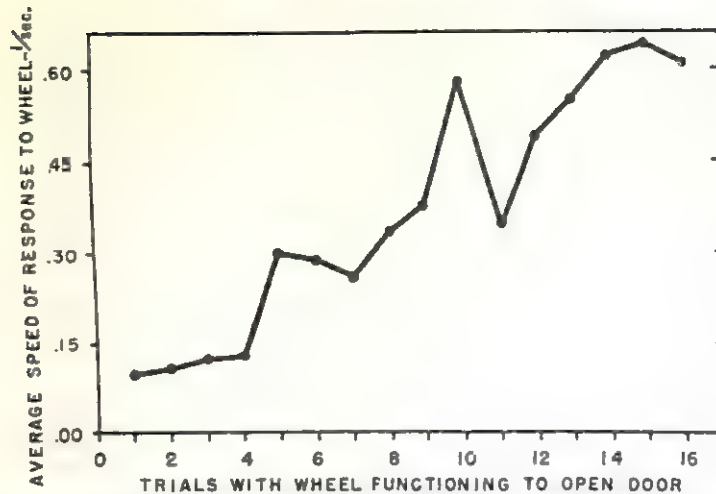


Fig. 3-3 Curve showing learning of the task of opening the door by turning the treadmill for animals taught to fear the white compartment. (From Miller, 1948.)

rests upon the energizing properties rather than the reinforcing properties of the fear motive. The development of their problem can also be reviewed in terms of the assumptions they make in proceeding to their operational hypotheses.

The primary assumptions are (1) fear has drive properties, or fear is a drive; (2) stronger drive leads to stronger expression of stimulus-response tendencies; and (3) there is an existing tendency (in white rats) for a response of startle to follow a loud noise (gun shot). Secondary assumptions

follow: (4) paired presentations of a neutral cue stimulus with a noxious stimulus (electric shock) will produce fear in response to the cue stimulus; and (5) the more paired presentations the stronger the fear. From these assumptions the experimental hypothesis is deduced—namely, with greater numbers of presentations of paired presentations of a cue (light) and a shock (or with greater strength of conditioned fear) there will result greater response of startle to a gun shot following briefly the presentation of the cue (fear) stimulus.

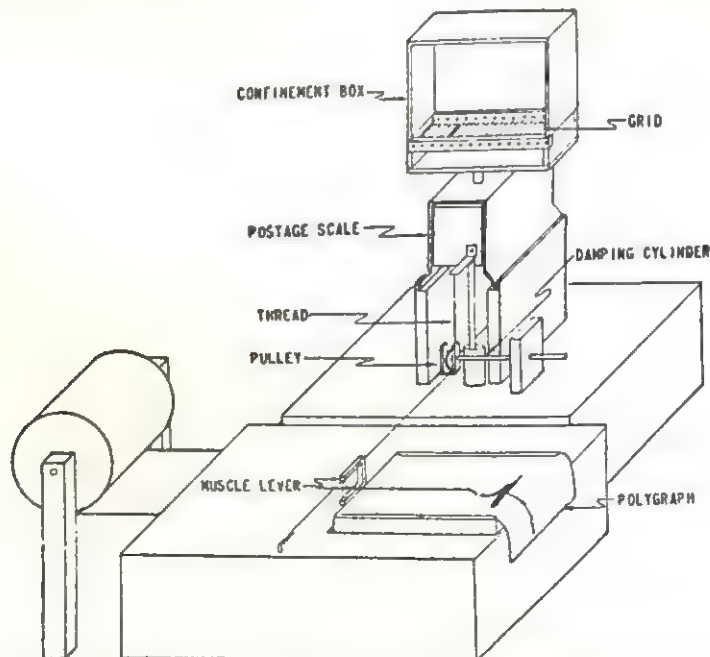


Fig. 3-4 Drawing of apparatus for measuring magnitude of startle responses in rats. (From Brown, et al., 1951.)

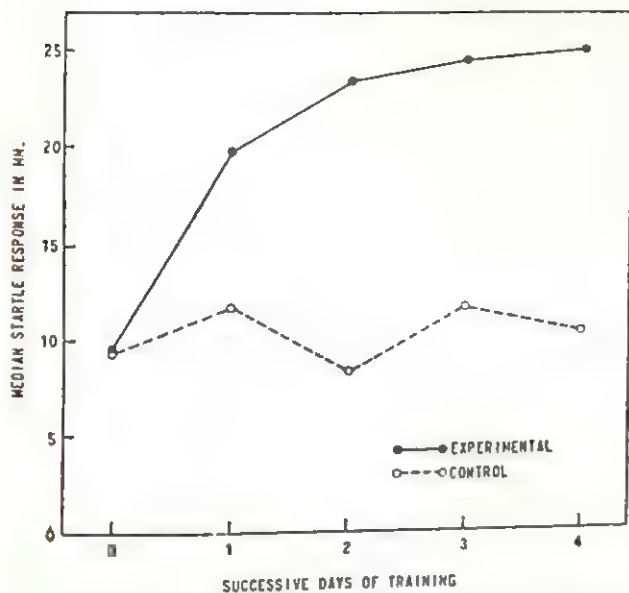


Fig. 3-5a Curves showing facilitative effect of conditioned fear upon magnitude of startle response to a loud sound. (From Brown, et al., 1951.)

Rats were placed in a stabilimeter-like device (see Fig. 3-4) and given a series of training trials, each of which consisted of the presentation of a neutral stimulus (a light-buzzer combination) and a shock. For an experimental group, the stimuli were paired in a manner designed to produce a conditioned pain response (fear) to the neutral stimulus. For a control group the temporal intervals between stimuli were such as to reduce or prevent the formation of fear.

Following the conditioning series, extinction

trials (cue stimulus presented alone) were given on each of three successive days. To test for the presence of fear, a loud, sharp sound was substituted at the time the shock was customarily applied (to the experimental animals) and the magnitude of the startle response was recorded. On the assumption that the startle reaction would be a function of the strength of the conditioned fear state, it was predicted that vigor of startle would vary concomitantly with operations designed to produce acquisition, extinction, and spontaneous recovery of fear.

The magnitude of the fear effect as a function of day of training is shown in Fig. 3-5a, and trials of extinction in Fig. 3-5b, for both the experimental and control groups. The data support the conclusion that "the pairing of a neutral and a noxious stimulus leads to the development of a conditioned fear reaction having motivational concomitants," and "that the momentary strength of this reaction can be inferred from the extent to which some other reaction, in itself never directly conditioned to the fear cues, is intensified at the time of fear arousal" (p. 327).

In looking back over these experiments it may be helpful to review the nature of the variation involved in terms of the earlier discussion of the experimental hypothesis and the independent and dependent variation. In the Brown, Kalish and Farber experiment the investigators wished to manipulate the amount or strength of fear (independent variable) and observe the effects of this variation upon the magnitude of the startle reaction (dependent variable). The operational defini-

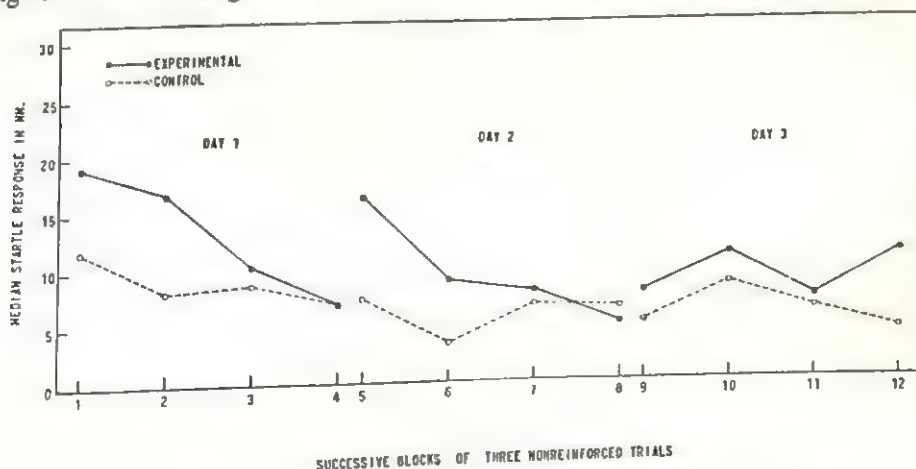


Fig. 3-5b Magnitude of startle responses exhibited by the experimental (fearful) and control (nonfearful) groups on successive days when the fear response was being extinguished. (From Brown, et al., 1951.)

tion of the dependent variable is easy to deduce from the description of the apparatus which is a device for indicating the amount the animal moves in a given time.

The independent variable, strength of fear, is not as readily expressed in operational terms. Strength of fear is defined operationally as the number of paired presentations of the signal cue (light-buzzer) and electric shock, and is labelled in Fig. 3-5a as day of training. It is later defined in terms of nonpaired (extinction) trials, Fig. 3-5b.

PERCEPTION

The previous experiments were characterized by somewhat complicated "jumps" of logic from general terms (like *fear*) to experimental operations (like number of paired stimulus presentations). The next type of experiment has a different special feature. This is the nature of the complex problem that arises when one wishes to experiment precisely upon what an organism sees, hears, or perceives. It becomes necessary to define important new concepts like "threshold."

The threshold is a descriptive statistical concept to indicate some point or distance on a psychophysical continuum. For example, an absolute threshold for visibility of a small light is an indication of the minimum intensity which the light must have in order to be seen. This is different from an acuity threshold where the indication might be the minimum intensity of an illuminated letter or symbol to be recognized as such, or for two lines to be recognized as two rather than as one. Another commonly studied threshold is the difference threshold, which expresses the magnitude of stimulus *change* which is required for discrimination of differences.

Studies to be described next are concerned with a special form of threshold, termed a *recognition threshold*. The quantification of the measure may be in terms of the intensity of illumination of a word (projected on a screen) that is required in order for that word to be recognized. Another common operation for defining the threshold is the minimum duration of the exposure (for very brief exposures of constant intensity) that is necessary for the word to be recognized. The recognition threshold has been an important concept to persons who have tried to evaluate the possibility that perception of objects is partly determined by

the motives and needs of the observer. One widely studied phenomenon of this type is termed "perceptual defense." This phenomenon illustrates well some of the difficulties which are encountered when one seeks to experiment upon what seems to be a simple behavior situation.

The essential procedure of the perceptual defense studies is to compare the recognition threshold for words (the dependent variable) as a function of certain properties of the words. The most obvious properties of the words focused upon in early studies was emotionality. The hypothesis for the study became "The recognition threshold for emotional words would be higher (e.g., it would take longer to recognize them) than for nonemotional words." The explanatory assumptions leading to the hypothesis drew upon "defense mechanism" hypotheses of psychoanalysis and spoke of the tendency for the person to protect or defend himself from discomfort or embarrassment by not recognizing the words.

In the situation used by McGinnies (1949) recognition thresholds for taboo or emotionally toned words were compared to thresholds for neutral words. Not only were the thresholds for the taboo words higher than those for neutral words, but also a physiological reaction, in the form of electrical skin resistance change, appeared more promptly to the emotional than to the neutral words.

Almost as soon as this study appeared, a lively literature grew, pointing out some of the experimental problems involved in the experiments, and some of the deficiencies in interpretation (see Howes & Solomon, 1950; Postman, Bronson & Gropper, 1953; and Eriksen, 1954). The fact of higher thresholds for taboo words than for neutral words was not in dispute. Instead it was the explanatory meaning attributed to the independent variation (taboo versus neutral words). Howes and Solomon asserted that the results obtained might readily be accounted for in terms of other variables of word familiarity and subject sets. Taboo words were found, through reference to published word counts, to be much less common or familiar than the neutral words. And it was considered necessary to assume the possibility that subjects have a tendency to withhold statement of taboo words, and that this factor (rather than defensive perception) might account for observed

differences. Postman *et al.* (1953) repeated the test of the hypothesis with special controls for factors of word familiarity, set, and selective verbal report and found no evidence to support the notion of a mechanism of perceptual defense.

About the time that study of these questions was at its peak an interest in a related phenomenon grew rapidly. It was termed "subception." The basic notion is that a person can be influenced by stimuli without being aware of them—a general proposition that had been explored experimentally several times since about 1900 but without strong confirmatory results. It should be noted in passing how closely tied to the concept of subception is the previously mentioned concept of perceptual defense. The argument would go something like this: how can a person show threshold differences before he is verbally aware of the threatening nature of the stimulus unless there is some form of perception without awareness?

As an illustration of the phenomenon, consider again the previously described study of McGinnes (1949). At the same time that he was measuring recognition thresholds for taboo and neutral words he was measuring the skin resistance (galvanic skin responses or GSR's) of his subjects. He found a significant difference in these GSR's to the two classes of words before the subjects recognized the words. He concluded that this indicated perception without awareness.

In a related study striving to control for variables like familiarity and verbal reluctance Lazarus and McCleary (1951) differentially conditioned the GSR to nonsense syllables by pairing some with shock and not so pairing others. The recognition threshold for the syllables had been independently determined for each subject so that on test trials the syllables could be presented at near threshold values with verbal report delayed for five seconds by instruction. The investigators compared the GSR's elicited by the previously shocked and previously nonshocked syllables incorrectly recognized at low durations of exposure, and found the GSR's to be larger to the previously shocked syllables. From this they concluded that the subjects must be perceiving differences between stimuli at a level below awareness or below conscious recognition.

As was the case with perceptual defense studies, the subception experiments stimulated a number

of criticisms, the most important of which was the contention that subjects do get information about stimuli even when their verbal report is incorrect. This is a variable termed "partial recognition" which other investigators sought to control by various means. Space does not permit extensive review of this literature. However, for the interested reader there is a comprehensive review of the problem and related literature by Naylor and Lawshe (1958).

At the conclusion of their article Naylor and Lawshe present summary tables which show in interesting perspective the effects of special experimental controls on research results. Their tabulation is reproduced in Table 3-1 which shows the count or number of studies in their bibliography which yielded positive or negative "instances" of the two phenomena when certain specified controls were employed.

TABLE 3-1

Number of studies yielding positive and negative perceptual defense and subception results, classified according to control used

Perceptual Defense Control	Positive Results	Negative Results
Word length	2	0
Word length plus word frequency	18	7
Word length, word frequency and verbal reluctance	5	7
Subception Control		
No partial recognition control	7	0
Control for partial recognition	0	3

It is interesting to note that in spite of the methodological difficulty in pursuing phenomena like perceptual defense, the central relevance of the concept to such personality theories as psychoanalysis leads to continued research. One of the most recent studies (Shannon, 1962) compared recognition thresholds for groups of individuals defined in terms of their use of different patterns of clinical defenses. Another recent article (Eriksen, 1960) reviews the methodological prob-

lems of discrimination without awareness as it relates to the concept of the unconscious.

PHYSIOLOGICAL PSYCHOLOGY

It will be recalled from earlier discussion that the main characteristic of physiological psychology as contrasted to other areas of study is that in physiological psychological research one of the main variables in the experimental hypothesis (either the independent or the dependent variable) is a biological one (physiological, anatomical, or biochemical). The other is a psychological (behavioral) one. This helps to differentiate physiological psychology from physiology where both variables are likely to be biological (or one physical or one chemical).

The above distinctions do not hold rigidly, however, because physiologists often use behaviorally defined variables (e.g., conditioned responses) primarily as physiological indicants rather than for their behavioral meaning. Similarly, there are many psychologists who use physiological measures for their implied psychological meaning. An example of the latter would be a measurement of the acceleration of the rate of heartbeat used as an index of emotion or fear.

Of the typical physiological studies where one variable is physiological and the other is psychological, the most frequent arrangement for the psychologist is for the independent variable to be the physiological one. The reason for this is that psychologists have been more interested in studying how behavior is determined by physiological factors than they have about how the organism's physiology is determined by behavior variables. This, again, is most natural since psychologists have been mostly oriented toward "explaining" behavior events and one way to explain them is in terms of known facts of biology or physiology. Note from the following titles from recent issues of the *Journal of Comparative and Physiological Psychology* that in each case the independent variable is an anatomical, physiological, or biochemical one and the dependent variable is a psychological one: "Effects of drugs on approach avoidance conflict"; "The relation between electrical conductivity of brain tissue and thirst in the rat"; "The effects of adrenal demedullation on retention of a conditioned avoidance response in the mouse"; and "Impaired acquisition of passive avoidance behavior by hypothalamic lesions."

The example chosen for discussion here is of the reverse variety, i.e., where the independent variable is a behavioral (psychological) one and the dependent variable is physiological. The area of study is related to psychosomatic medicine where gastric ulcers are being studied as a function of certain psychological "stress" conditions imposed upon the organism. The animal being observed is the monkey who experiences certain tasks, like learning to press a lever to obtain food, while seated in a chair-like restraining device, illustrated in Fig. 3-6.



Fig. 3-6 Restraining chair for studying learning in monkeys. (From Porter, et al., 1958.)

The experiment is one of a series of what are termed "exploratory" investigations to find out what the behavioral determiners of the gastric ulcer might be. One main feature of an exploratory experiment is that it is more for the purpose of "teasing out" relevant independent variation than it is for definitive testing of relations among well-known variables. In other words, the exploratory experiment is as much oriented toward developing meaningful new explanatory relations among vari-

ables as it is in pinning down a test of a particular relation. Consider the problem area at issue here, the psychological contributors to ulcers. One may begin with only a vague relation to the effect that "psychological stress" seems to contribute to the development of the abnormal physiological condition. One can measure the presence or absence of ulcerated tissue by performing surgical autopsies on animals and through gross microscopic examination demonstrate ulceration, hemorrhages, disorganization of the mucosal linings of the intestines.

But how can one determine or define the elusive concept psychological stress? This is the independent variable that it is desired to manipulate to note the effect upon ulcer formation. Exploratory experimentation might have as its goal the trying out of a series of possible operations for defining such stress. Those found to be most effective in producing physiological change could then be more carefully defined and elaborated. In the series of studies reported by Porter *et al.* (1958) a descriptive analysis of a group of monkeys was performed where various instrumental conditioning procedures were given to subgroups of animals and extent of ulcer development checked. One procedure involved lever pressing for food reward, then the disruption of this behavior by an anxiety response conditioned by pairing a sound with an electric shock, then presenting the sound during the lever-pressing period. Another procedure instituted a punishment to accompany the lever pressing for food. Still another taught the animals to avoid an electric shock by pressing a lever.

Because of a high incidence of ulcer formation in animals subjected to the experimental routines, as contrasted with control animals, it was decided to proceed to more systematic study of one of the behavior variables, that of avoidance conditioning. Two pairs of monkeys were selected by matching them on species, size, weight, and sex. One member of each pair was designated an experimental animal, the other a control. They were conditioned according to a "yoked chair" procedure whereby the experience with noxious stimulation (shock) for the two animals in a pair were identical but in the case of only one animal was the experience contingent upon the behavior of the animal. In other words, the avoidance procedure permitted only one animal to manipulate the delay of the shock by pressing a bar. That animal learned to

perform the lever pressing response to avoid the shock. The other animal, because his chair was "yoked" to that of the first animal received exactly the same number and temporal distribution of shocks. The authors felt this equated what they called the "physical trauma" aspects of the experiences of the experimental and control animals. In addition, then, the experimental animal possessed a "psychological stress" factor of responding in order to avoid the shock. The training period extended over more than twenty-five days and was terminated in each case by death of the experimental monkey of each pair. The control animals were sacrificed immediately and complete autopsies were done on all animals.

The severity of the effect of the avoidance training procedure had not been predicted from the earlier experimentation. The autopsies showed in the case of both experimental animals severe gastrointestinal ulceration. Neither control animal showed abnormality of the gastrointestinal tract. The interpretation of the results by the authors is most relevant in this context:

The results of these experiments indicate quite clearly that the incidence of gastrointestinal disease is significantly greater in a population of rhesus monkeys subjected to chronic behavioral conditioning than in laboratory monkeys not so conditioned. The complexity of the behavioral conditioning procedures makes it difficult to isolate and analyse the specific psychological factors contributing to the etiology of these somatic changes. Although there would appear to be little doubt that certain aspects of the behavioral situations under study have figured prominently in the development of gastrointestinal finding, the precise nature of these "psychosomatic" relationships must continue to be speculative with only the present data at hand (Porter *et al.*, 1958, pp. 389-390).

Another way to phrase the point being made in the last sentence of the quotation is that the operations involved in defining avoidance behavior (as contrasted to nonavoidance behavior) are quite general. They do not pin down specific determining factors. For example, the avoidance procedure demands of the animal high degrees of attention and rapid discriminations among changing aspects of his environmental situation. Is it this that produces the difference? It could even be that the situation is more fatigue-producing for the experimental animal. Or it could be more vaguely postulated that one animal learns to worry about

the shock coming on while the other does not. Gross statements like this illustrate the important need for careful definitional processes in establishing concepts for explaining behavior phenomena. Such initial, or exploratory, experimentation provides clues from which meaningful subsequent hypotheses can be deduced and fruitful refined experiments developed. The reader may wish to refer to a discussion of this particular research in a more detailed treatment of experimental method (Sidman, 1960, pp. 11-12).

SOCIAL PROCESSES

The preceding example showed clearly that some experimental psychologists have a preference for relating behavior to determining anatomical, physiological, and biochemical variables of the biological sciences. The next will show another, equally energetic, group of experimental psychologists turning to variables defined in terms of characteristics of society and our social order. In some respects the variables of the social scientist are not as easily denotable as those of the physical and biological scientist. They are harder to point at directly or to measure with conventional physical measurement systems. Further they are said to be "complex" in the sense of being determined by many factors. Another important feature is the difficulty in manipulating social variables for purposes of experimentation.

One interesting feature of social research is that it stimulates the development of new research techniques and makes possible the comparison of experimental approaches with other methods of study. The example to be discussed was chosen because the investigators have prepared for interested persons a very informative comparison of results derived from experimental and survey studies of the same social phenomenon, that of change in attitude toward social issues.

The question is how changes in an individual's attitudes or opinions are brought about. Since an attitude is a form of predisposition for a person to act a certain way in a certain situation, it becomes an important element in social behavior. It might determine how he votes, whether or not he goes to church, or how he gets along with his family or his neighbors. This makes "attitude" quite a pervasive concept in social psychology.

The phenomenon under study by Hovland and Pritzker (1957) is the change in a subject's or a

group's opinion (attitude) which results from communication information about the opinion issue. In this case the information supplied is about the opinion held by certain authority figures and the implication was one of three possibilities: one advocating an opinion slightly different from the one originally held by the individual; one advocating a moderately different opinion; and a third a greatly different view.

The general procedure was as follows. First, each individual's opinion on a variety of social issues was determined by rating scale methods. After each question the subject was asked to indicate which of several specified authority groups he would most respect with reference to the particular issue. One month later the same subjects had their opinions again measured on the same issues, except that this time each opinion item was accompanied by a statement which purported to indicate the attitude of the authority group that had previously been designated by the subject. The *degree* of recommended opinion change intended to be communicated to the subject could be manipulated by using gradation of authority opinion. For example, in one case a subject who strongly disagreed with an issue could be faced with a communication to the effect that the authority group agreed with the issue. This might be termed a communication of a marked change. On the other hand, if a subject's original opinion was "agree strongly" a slight communication change would be accomplished by the authority group's opinion being given as "agree slightly." In this way the stated opinion of the authority group could be used as the communication (independent variable) and could be varied according to the subject's initial position on the issue. One third of the subjects were subjected to a communication position with "slight change" from the initial; one third received a "moderate change" communication; and the remainder received a "marked change" communication. The dependent variable became the change in rated opinion of the issues by the subjects, computed as a difference score (rating-after minus rating-before, with adjustment for direction of change).

The results indicate that the communications which advocate a greater amount of change produce a greater change in attitude of the subject than do communications which advocate lesser

amounts. In other words, greater change in opinion is brought about by large than by small amounts of advocated change. The observed effect was independent of the subject's initial position on the issue (same for those initially holding extreme and those initially holding neutral positions on the issue). It had been predicted that a "boomerang" effect of resistance to the communication would occur such that changes in direction opposite to those advocated might appear when maximum change was indicated. This result was not obtained.

In review, a change in attitude toward social issues is being measured as a dependent variable. The change is being studied as a function of communications concerning the implied attitude of authority groups about the particular issues. The main independent variable, then, is the amount of change advocated, manipulated in such a way that small, medium, and large amounts of change could be advocated for subjects independent of their initial position on the issue.

The investigators, however, were concerned that "these results are not in line with our hunches as to what would happen in a naturalistic situation with important issues" (Hovland, 1959, p. 11). Another study was, therefore, designed to retest the questions. It was suspected further that the previous results might be partly a product of the experimental method and that survey procedures might show different effects.

Before turning to the follow-up study and its conclusions, it is necessary to say a few words about differences between experimental and survey research. Both methods study relations among variables and in both cases the emphasis is upon objective observation. The difference is in the types of issues studied and the manner in which independent variation is produced. In experimentation, the experimenter must somehow produce the independent variation. He must control (manipulate) the independent variable, a fact which limits the study by this method of many broad issues where independent variation is "produced" by nature or by complicated social determiners.

The survey emphasizes description of variation as it occurs "naturally" and is a broad observational method with objective methods of observation and recording of information. It applies to specific, objective, descriptive accounts of vari-

ables, individuals, and events. Its extensiveness can be seen through some of its subgroups. One is the *field study* which is a survey carried out "in the field" or in the place where people and events are found in their normal course of activity. Another is the *developmental study* where emphasis is on showing the course of change in behavior over some period of time. Still another is the *differential study* where stress is on describing differences between individuals, events, social classifications, and the like. The *opinion survey* is a special class of differential study focusing on differences in attitude among individuals or groups.

To return to the example of attitude change resulting from communications suggesting the attitude direction or degree, Hovland, Harvey, and Sherif (1957) studied changes in attitude produced by a communication in the survey setting. They chose the single issue of attitude toward prohibition and toward repeal in a "dry" state during a period when the issue was up for vote. Subject's initial attitudes were surveyed on eight statements representing stands from strong advocacy of prohibition to strong view toward repeal. Degree of "ego involvement" was checked by selecting subgroups of persons publicly committed to one side or the other of the issue.

One to three weeks after the first determination the subjects were seen a second time and a communication was presented by tape recording. There were three types of communications: "wet," "dry," and "moderately wet." The "wet" or repeal communication was presented to the extreme dry and unselected subjects. The "dry" was presented to the extreme wet and unselected subjects. The "moderate" communication was presented to wet, dry, and unselected subjects. Following the communication a second measurement of attitude was obtained. In addition, reactions of the subjects to the communication was obtained on like-dislike, reasonable-unreasonable, and propaganda-fact dimensions.

It was found that the degree of distance between the recipient and the communication definitely influenced the results. When the distance between a person's attitude and the position advocated in the communication was small, the person judged the communication as fair and factual and the tendency was to assimilate the attitude communicated. On the other hand, when the observed

person's attitude diverged widely from that communicated to him, he tended to judge the communications as unfair and reacted against the attitude communicated.

Since these results differed from those of the earlier experiment, the authors were led to emphasize the fact that different research methods can produce uniquely divergent results each of which may be valid in its proper context. With respect to the present context of producing changes in attitude, Hovland has the following comment to make:

The implication of these results for our primary problem of conflicting results is clear. The types of issues with which most experiments deal are relatively uninvolved and are often of the variety where expert opinion is highly relevant, as for example, on topics of health, science and the like. Here we should expect that opinion would be considerably affected by communications and furthermore that advocacy of positions quite discrepant from the individual's own position would have a marked effect. On the other hand, the types of issues most often utilized in survey studies are ones which are very basic and involve deep commitment. As a consequence small changes in opinion due to communication would be expected (Hovland, 1959, p. 13).

SUMMARY

The experimental psychologist is described as a person who seeks to gain an understanding of behavior events by the use of the experimental method. He defines concepts for describing and explaining psychological events and relates these concepts to one another in an integrated fashion. Some of these relations become the focus of an observational test. The relation is expressed as an empirical proposition, termed an experimental hypothesis, where one concept is usually expressed as having some form of determining relation to another. The determining concept is termed an independent or experimental variable, whereas the determined variable is spoken of as a dependent variable.

The critical feature of the experiment is the manipulation of the independent variable by the experimenter, with careful observation of the resulting change in the dependent variable. Special care must be paid to ensure that the only variable being changed is that to which the resulting effects

on the dependent variable are attributed, i.e., that the experimental test is not confounded by extraneous determining variation.

Problems given experimental study range widely with motives and interests of investigators. Many stem from complex exploratory systems and theories and arise as tests of deductions made from the theories. As such they become closely knit into a complex of many and interrelated experiments. Others are quite limited in scope, being designed to test a specific methodological question or practical issue. Whatever the origin, the criteria for the experiment remain the same—the experiment must provide an objective test of an empirical relation, through experimenter manipulation of variation.

In the material presented it was not possible to delve deeply into the refinements of the process of behavior experimentation. This remains the task of specialized treatments of experimental methodology. Instead, it has been possible only to sketch the rudiments and more central notions of experimentation, and to endeavor, through the use of a few illustrative examples, to catch some of the flavor of actual experimentation upon psychological matters. For further detail and examples, the references by Andreas, Brown & Ghiselli, Humphrey, McGuigan, Scott & Wertheimer, Sidman, Underwood, and Zimny might be consulted.

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CHAPTER 4

Physiological Psychology

GENERAL ORIENTATION

Psychology, in most of its branches, studies the activity of human (and sub-human) beings as total organisms. With attention generally centered on behavior as a whole, it seems convenient to regard man as an integrated biological unit reacting to its external environment through selective response and with psycho-physiology given the problem of studying the bodily mechanisms involved. Unfortunately, in their long fight against animism, psychologists have tended to adopt an antiquated conception of how the human machine functions physiologically. As a model, they took a stimulus-response formula, the simple reflex, in which knowledge of sense-organ input (*S*) and peripheral-nerve outgo (*R*) was conceived adequate to chart any total behavior phenomena, including perception, motivated learning, and concept formation.

This adherence to belief in strictly external stimulus control is no longer satisfactory theory. Almost without exception, psychologists now recognize a selective central nervous factor that reinforces or channelizes now one response, now another. By rejecting the idea of sensory control of most total behavior, we thus find ourselves back in modern times. Convenient as was the *S-R* formula for describing simple conditioning, behavioral research now conceives of the brain as a very complicated neuro-electronic system behaving somewhat like an IBM computer. That is, it is full of things like capacitances, storage condensers, interfering "neural-noise" levels, and looped switchback-circuits capable of producing responses only remotely connected to an alleged external sensory input. This new overview makes study of psycho-physiological function in the intact organism vastly more difficult. Not only do we consider bodily parts working together and in isolation (as in the eye's blink reaction to a flashing light); we also must enquire into mediating and autonomous processes which "set" the total brain flux to ignore or enhance a given sensory thrust. Only recently have we come to realize that a given response outgo, instead of

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merely removing a stimulus irritant, can also cause an afferent feedback excitation, which disturbs the body's chemical balance and brings on colitis or some other psychosomatic disorder associated with residual tensions.

The beginning student is cautioned, however, against moving towards these higher reaches of theoretical neuro-electronic and chemical effector action until he has mastered a basic knowledge of functional body parts, while considering their dynamic implications. True, the experimental recordings of brain waves may some day enable us actually to see "the inner thoughts of a given subject projected on a television screen"; but before we arrive at that stage, we must master what is now known of the intricacies of man's three-part neuromuscular system (receptors, adjustors, and effectors).

The anatomy and physiology of sense organs, receptors, gland and muscle effectors, and the neural adjustors which intervene, all contribute to an understanding of man's behavior as a whole. Breakdown of a total function is almost invariably due to breakdown in the action of some part, because behind the relatively simple front of each overt action lies a background of great complexity. The attempts of the physiological psychologist to unravel the mysteries of this background can be compared with the efforts of a mechanically-minded individual to understand the workings of an automobile. In each case much has to be mastered that is only indirectly related to the action of the total machine. In comprehending an automobile, one must be able to appreciate the principles of internal gas combustion, gear reduction, and friction loss before the workings of the automobile become clear. So the physiological psychologist needs to attain a thorough understanding of bodily structures and functions before attempting his examination of behavior mechanisms. But this is not the full extent of his task. Knowledge which comes from the study of body parts in isolation does not satisfactorily explain the more complicated forms of behavior. The facts and theories developed from such work must be tested experimentally for their application, through physiological recordings of the operation of the intact organism. And, since parts usually act differently together than when taken apart, integrative action becomes the major problem in physiological psychology.

PSYCHOLOGICAL FUNCTION AND BODILY STRUCTURE

With no exact correspondence possible between psychological function and bodily structure and with every bodily part capable of contributing to several different psychological activities, to speak of the brain as the "seat of consciousness" and of the glands as the "basis of emotion" is an unwarranted simplification of our problem. Since a number of bodily structures are yet without well-defined functions, and many psychological disorders have no known organic basis, the physiological psychologist leaves a writing of the neuro-electronics of emotion, learning, and other activities until such time as their psychological analyses are more adequate and their bodily correlates are more sharply defined. By setting out first to understand the basic bodily systems and second to apply that knowledge to total behavior, he is more likely to achieve scientific advance than if he begins with alleged psychological functions first and proceeds to hypothetical, unsubstantiated, and inept physiological explanations. It is very significant that so many positive statements made about the bodily mechanisms involved in performance have turned out to be untrue! Consequently we are concerned mainly with certain physiological processes known to govern integrated behavior and with the contributions of different bodily structures to these processes.

THE ENERGETICS OF BEHAVIORAL ACTIVITY

The human organism may be regarded as a machine specifically designed for changing energy from one form to another. Energy is stored by transforming the foods that we eat into forms which can keep the nerves, muscles, glands, and other bodily parts in a state of waking readiness for reaction to stimuli that excite our sense organs. Energy is released in our behavioral performances, which vary in complexity all the way from involuntary startle at a noise to solving a problem in higher mathematics.

But although energy outgo often involves responses to external stimulus effects, we must not neglect the fact that internal stimulus conditions can also "set" the organism and produce response outgo. To understand this state of affairs, one must realize the human organism is not a truly inert machine, to be set into motion only by ap-

plication of outside energy sources. External stimuli (such as air vibrations producing a sound) or internal ones (such as stomach cramps producing an ache) act merely as "trigger charges" for releasing energies already stored in the specific tissues which are the real determinants of response. In both cases the energy transformation or turnover that takes place when we react to stimulation is known as work, and our efficiency, like that of other machines, could conceivably be measured by dividing the energy input by the work output.

Although energy outgo usually involves neuromuscular reactions to external stimulus effects, it is still possible for the internal system to stimulate and react of its own initiative. To understand this, we must realize that human activity is organized around three complementary systems: digestive, circulatory, and neuromuscular. As indicated in Fig. 4-1, food energies are changed by

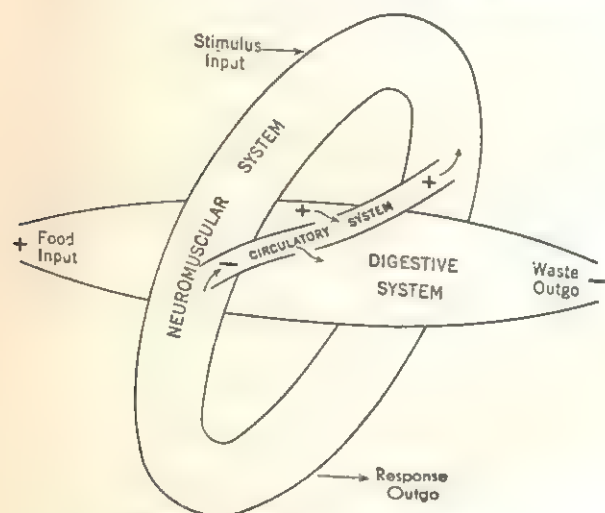


Fig. 4-1 The plan of the body.

the digestive system into a concentrated type of chemical fuel which is made easily available by the circulatory system to tissues of the neuromuscular system. External and internal stimulation of these tissues merely touch off fuels available to the latter system when a response is made.

Since these three systems tend to act as a unit, the key to the "why" of organic response is to be found more in the complicated energy-exchanges going on within the body tissues than in the work of outside stimulus energies acting upon them. The sight of water does not lead a man to drink unless he is thirsty, and a certain inner physiologi-

cal state must be operating before the mere presence of a mate leads an animal to make sexual advances. It is a fundamental biological fact that the behavior of all living organisms tends to be self-regulatory and not that of a robot, controlled by the external promptings of a fortuitous and changing environment. This self-regulation involves (1) basic tissue conditions which, upon reaching states of excess or deficiency, give rise to internal stimulations and so excite the organism to general activity, and (2) mechanisms of overt reaction which are potentially able to secure needed satiation and return the internal tissue conditions to a more normal state, hence restore the homeostatic equilibrium of the entire apparatus. In the absence of food or mate, activities appear which tend to provide them. Such reactions are of direct and immediate value to the organism as contributors to restoring equilibrium of basic inner tensions. So too are the more remotely aroused anxieties and frustrations resulting in equilibratory acts which may seem purposeless to the onlooker.

The physiological psychologist's interest in the energetics of activity builds primarily around the question of *arousal level* and of the *control mechanisms* which direct the behavioral discharge. Studies showing that hunger contractions of the stomach coincide with periods of heightened general activity have indicated the importance of internal conditions in the energy mobilization of overt response. Experimental removal or implantation of the several endocrine glands have contributed greatly to our knowledge of even more diffuse energizing effects in which the tissue "need" does not lead so directly to overt behavior, but manifests itself mainly in raised metabolism, with increased arousal of other bodily tissues, including psychosomatic disorders. In the matter of control mechanisms, it is fairly certain that the "spontaneous" arousal of tissue demands and the blocked outflow in autonomic upsets are rather nonspecific, being supplied with a minimum of internal "steer" or direction. The glandular-circulatory system is much better adapted for conserving existing bodily energies than for acquiring or avoiding new stimulus effects which are beneficial or harmful to continued organic function. The latter need tends to be referred to the neuromuscular overlay-apparatus, whose chief characteristic is a maximum capacity for change or modification of behavior

in the most appropriate direction. Thus, whenever the body is disturbed or forced into a state of disequilibrium, the raised arousal level of the superposed neuromuscular system should so adjust the organism in the environment as to acquire or develop responses capable of producing more or less adequate relief. This strategy sometimes fails, as indicated by the presence of ulcers and residual muscle tensions which instead of lowering the system's level of arousal produce backward flow (system-feedback) to continue the disturbance. Since environment and inner status is ever-changing, great functional plasticity is essential to a sound response apparatus.

THE NEUROMUSCULAR APPARATUS

The neuromuscular apparatus is not a homogeneous affair, but is organized in relation to a three-fold plan, including the afferent receptors, the central brain, the autonomic (cranial-spinal) nervous adjustors, and the motor effectors (see Fig. 4-2).

Stimuli act on internal and external receptor organs; the energy released by these structures supplies the charge which excites the central and autonomic adjusting neurones. These nerve cells,

in turn, discharge upon some motor or glandular effector organ, which develops a behavioral response. A cross-sectional view of the neuromuscular apparatus at any moment would show a vast number of nervous discharges passing from receptors of the eye, ear, and inner tissues to the brain and autonomic spinal centers of the nervous system, while an equally vast number of discharges are passing from these adjustor nerves to the effector organs, the muscles and glands. These nerve discharges are electrochemical phenomena which accompany energy transformation in nerve cells, and their detection by delicate electrical amplifying devices gives us some idea of how the neuromuscular apparatus is doing its work.

Nerve discharges touched off by stimuli of external origin are not generally chained directly through a stereotyped circuit to a particular motor outlet. Instead, such discharges on reaching the adjustor centers have to be integrated or made to fit with excitation of internal origin before the discharge leading to appropriate motor response is released. In this way the integrity of the total apparatus is preserved; and much incongruous and harmful behavior is avoided, such as removing an irritating stimulus from the back of the

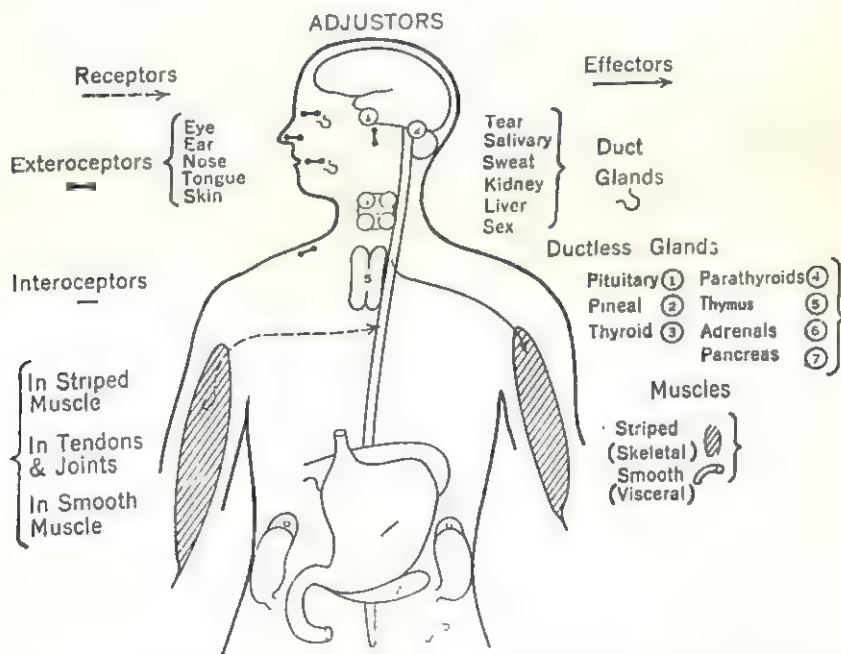


Fig. 4-2 Neuromuscular apparatus. Different symbols are used for each type of organ to indicate its approximate location. Only the ductless glands are numbered because of their motor functions. are properly classed along with muscles as effector organs because of their motor functions.

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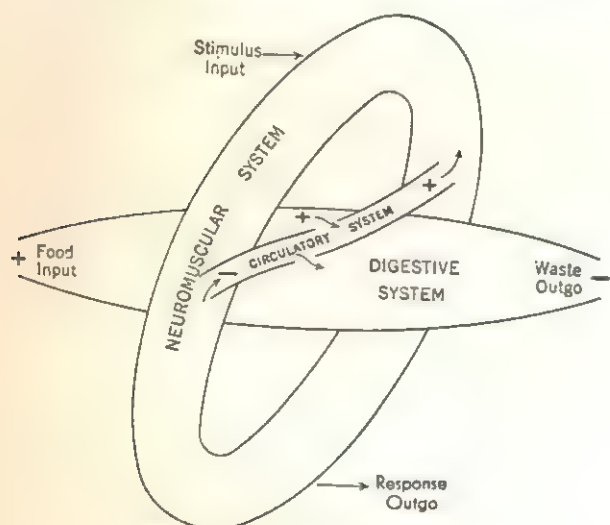


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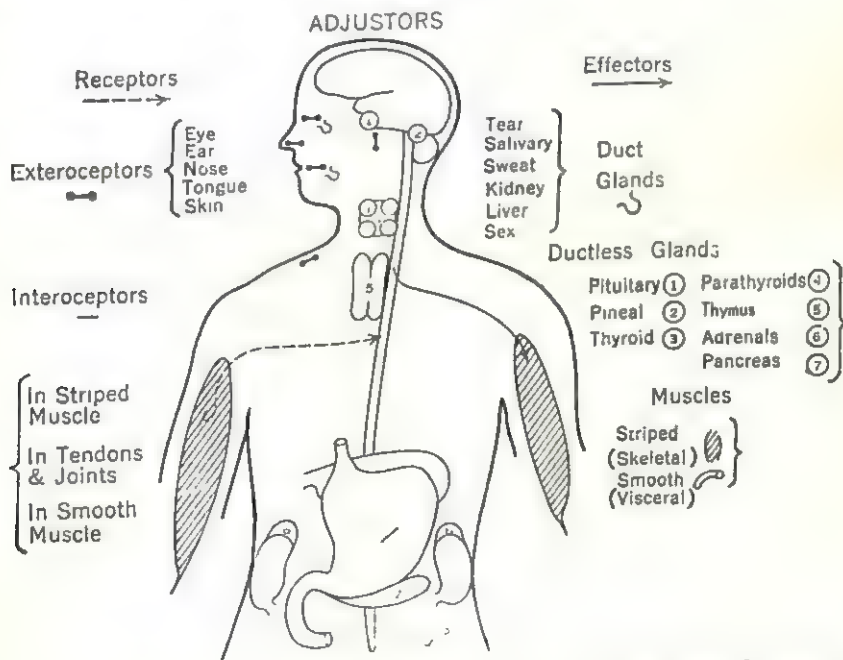


Fig. 4-2 Neuromuscular apparatus. Different symbols are used for each type of organ to indicate its approximate location. Only the ductless glands are numbered for specific identification. Glands are properly classed along with muscles as effector organs because of their motor functions.

neck when one's arms are already engaged in keeping the body from falling out of a tree. Unfortunately, as we shall shortly discover, stimulus input is often not well-matched by response output. When the neuromuscular apparatus under- or over-reacts to stimulation, the system's balance is upset and we tend to get residual tensions, afferent feedback, and continued bodily upset. This indicates the complicated problem of harmonizing the interactions of our three-fold reaction apparatus.

METHODS OF INVESTIGATION

Many different techniques are used by physiological psychologists in the study of behavior mechanisms. Where the problem is largely that of determining the functional contributions made by some particular part of the neuromuscular apparatus, that part may be removed and behavior after extirpation compared with that prior to the lesion; or the part may be stimulated electrically and concomitant changes in behavior noted. Sometimes the problem is to find the major adjustor centers involved in a given performance, and here the activity in question is initiated while various neural structures are explored for electrical signs of heightened activity. These three methods are largely limited to animal experimentation. Many difficulties arise from trying to "homologize" or relate the connections found between structure and function in animals with analogous activity in man. Correlations between behavior changes and pathological lesions are often helpful, as in the connection between speech loss, or aphasia, and the locus of brain tumors. An even more fruitful method takes various physiological indicators of central and autonomic nervous function such as blood pressure, galvanic skin resistance, or electrical "waves" from the brain, and studies changes occurring in them during performance of the intact human organism. Since such physiological reactions are extremely sensitive and not under voluntary control, they are often of great diagnostic value, as with the use of blood-pressure changes in the detection of guilt or brain-wave records to warn of impending epileptic seizures.

From this brief overview, it appears that physiological psychology has important practical bearings and is, at the same time, a very complicated field of study. Those specializing in it must be

rather versatile persons, mastering many difficult neuro-electronic recording techniques, and having a considerable background of knowledge of anatomical and physiological detail in order to interpret their results. In the sections which follow we shall see specific applications of the various methods to the study of the gross divisions of the neuromuscular apparatus.

SENSORY FUNCTIONS

By virtue of the place which they hold in the three-fold plan of neuromuscular action, afferent receptor mechanisms are primarily concerned with the initiation of behavior. With the exception of the cases of muscle and gland excitation by autocoid substances in the blood stream, man reacts only to energy changes affecting his external and internal sense organs. These influences or stimuli give qualitatively different effects, such as red, green, pressure, pain, tension, glow or inner warmth, and quantitative changes such as in intensity and in duration. The physiological psychologist is especially interested in how these two different aspects of excitation function are handled by the receptor organs.

Receptor structures are specifically differentiated cells with low thresholds of excitation for certain kinds of stimuli (called "adequate") and high thresholds for all others. They either exist as more or less independent units distributed throughout body tissues, as in the skin and muscles, or are collected together in elaborate sense organs, which possess in addition to the specially sensitized tissue a number of accessory parts adapted to concentrating particular kinds of stimulus energy thereon, as in the eye and the ear. Receptors are divided into two great classes, depending upon their adequate stimuli. (1) The exteroceptors are a part of the body surface; they include the eye, ear, nose, tongue, and skin, and react to stimuli in the external environment. (2) The interoceptors are embedded in the inner body tissues, especially the muscles and digestive organs, and react to pressure stimuli arising from the activity of these parts, that is, the internal environment.

QUALITATIVE VARIATIONS

Much speculation has been aroused concerning the relationship between the various receptor struc-

tures and the different qualitative experiences or sensations. According to a now discarded view, nerves from the eye, ear, etc., carry a different type of discharge or a "specific nerve energy." We know today that all nerves that convey excitation from receptors to the central nervous system behave in approximately the same manner, and the fact that each sensory nerve is associated with a special type of response is determined largely by the kind of tissue with which that nerve connects. This means that if it were possible to attach the optic nerve to the ear and the auditory nerve to the eye, we might be able, as has been said, "to see the thunder and hear the lightning."

Search for the origin of the various sensory qualities in the terminal receptor and brain cells of the sensory circuit has given rise to a controversy of wide implication. The most common view supposes that specialized receptor structures exist for each quality in a given sense modality, and that the analysis is, therefore, peripheral. An alternative notion is that the receptor structures in a given sense organ, such as the eye, are largely alike, and that the total pattern of stimulation is sent forward to the brain for "central" analysis. The classic example of the specialized receptor theory is one which suggests that each of the different receptor structures in the skin responds exclusively to one type of stimulus—one for warm, another for cold, and so on. Direct correlation studies have shown, however, no specialized receptors under any warm or cold spots of the skin—only free nerve endings and afferent fibers in blood vessels; and recent work on the differential effect of warm and cold stimuli upon these undifferentiated end organs suggests the importance of central brain processes in the analysis of sensation. In the field of hearing, where the specialized receptor theories are also more traditional, study of the electrical responses of the auditory nerve lends some support to a theory of central analysis. Even in the field of vision, where either specialized structures or qualitatively different photochemical substances in the eye have always been proposed as the basis for the sensations of color, the importance of central brain factors begins to be recognized. It is, of course, too early to state in any one of these fields the relative importance of receptor and brain cells in the qualitative analysis of sensory functions; but it is certain that this domain should provide a veritable bonanza for

any research worker with a fruitful imagination and training in use of refined electro-physiological equipment.

QUANTITATIVE VARIATIONS

Much more is known concerning quantitative variations in sensory functions. These variations have to do with the amount of inertia of the receptor and time relations in the associated nerve discharge. According to the all-or-nothing law, each receptor cell has a quantity of energy ready for discharge, and any stimulus that is of sufficient intensity to overcome the "threshold" inertia of the receptor and touch off that energy, discharges the whole of it. Increments in stimulus intensity, if registered in the brain, would therefore represent the involvement of more receptors. Also contributing to intensity is the increased frequency of discharge for each receptor, since stronger stimuli excite the nerve earlier in its resting or refractory period.

Since the number of receptors in any given sense organ is limited, the question of gradations in response becomes an important one. From the time of Weber and Fechner it has been known that the minimum increase in stimulus intensity necessary to be sensed as just perceptible, becomes progressively greater as one proceeds from low to high intensity. The logarithmic relationship between the increase in the frequency of nervous discharge and the stimulus quantity agrees with the first observation and means that most of our receptors are sensitized to respond to the lower range of intensities. When the stimulus is more intense the receptive apparatus is relatively unresponsive, having few units which remain to be discharged by the added increment.

The duration of a stimulus as well as its intensity affects the receptor mechanism, and under prolonged activation the receptor loses its excitability. This is known as sensory adaptation and it depends upon the fact that receptors and their associated nerve fibers respond at different rates to the same external energy charge. The receptor loses its excitability very slowly, while the associated nerve cell responds, rests, and responds again many times before the receptor itself rests. The receptor thus operates after the fashion of an electrical interrupter in changing a continuous stimulus into a series of discontinuous nerve discharges, between the passes of which the nerve

cell is able to recover its excitability. Of course if the nerve cell were stimulated sufficiently long, it would be excited earlier and earlier in the refractory period when it is supposed to rest, and would ultimately be entirely exhausted. But before this great physiological impairment occurs, the receptor will itself have become inactive and no further stimulus effect will be transmitted to the sensory nerve and other parts of the central nervous system. This buffer action of the receptor in sensory adaptation actually protects the brain cells from possible fatigue effects brought on by prolonged external stimulation.

MOTOR FUNCTIONS

Effector structures are specialized types of cells that react in specific ways to nerve discharges conveyed by receptor and adjustor units. All have a relation to the general function of motility. The striped or skeletal muscles move the body framework about in the environment field. The smooth muscles of the hollow viscera (stomach, intestines, blood vessels) contract and relax to maintain the steady flow of fuel energies throughout the body, and the duct glands (tear, salivary, sweat) provide essential substances for the same end. Secretions of the ductless or endocrine glands pass directly through the gland cell walls into the blood stream, where they are carried to organs, muscles and nerves, raising and lowering their activity. Physiological psychology has two general problems connected with the action of these effector mechanisms, the muscles and glands. One is to classify specific mechanisms involved in overt adjustments. The other is to determine what afferent feedback, or backlash, effector action has upon the receptor and adjustor parts of the neuromuscular apparatus.

We have already seen that man is no mere touch-and-go mechanism, turning external "stimuli" into external "responses." Muscles and glands, besides serving to effect specific adjustments which will favorably modify the organism's relation to the external environment, act to sustain and energize the rest of the reaction apparatus. For purposes of discussion, we shall classify functions of the first type as *phasic reactions*, and functions of the second type as *tonic reactions*. The phasic re-

sponse is of short duration and usually represents a temporary adjustment to some momentary and fleeting stimulus, as in the reflex withdrawal of the hand from a heated object. The tonic response represents a more enduring but less specific adjustment calculated to sustain a certain continuity in the organism's conduct by supporting appropriate phasic responses, as in the general postural alertness which accompanies unexpected contact with a harmful environmental stimulus. Phasic acts of a voluntary or reflex nature occur only when the muscles are in a state of slight tension, and these same tonic activities by supplying a major share of backlash excitation to the brain cells are largely responsible for their lowered thresholds to sensory excitation during waking activity. Since practically all effector organs have both phasic and tonic functions, it is hard to assign each type of reaction exclusively to a given class of effectors. On the other hand, it can be said that tonic bodily trends of alertness or lassitude are largely influenced by the activity of the ductless or endocrine glands and by the maintained states of slight muscular tension, while the more intense and short-lived contractions of skeletal muscle and the secretions of the duct glands contribute little to tonic functions. Attempts at more precise distinctions stress the evidence for two different kinds of muscle tissue, differences in central adjustor control and differences in sources of sensory stimulation. But until there is more general agreement on these points, we may think of all effector mechanisms as potentially capable of phasic and tonic reaction. And while it is often difficult to segregate the two, every motor adjustment gives some indication of the mutual contributions of activity specifically directed toward the source of stimulation and of widespread supporting postural adjustments.

PHASIC REACTIONS

Qualitatively different phasic reactions, including the many exact adjustment mechanisms for maintaining balance, grasping objects, or rejecting harmful substances from the digestive tract, cannot be adequately surveyed in our limited space. Instead we shall confine ourselves to certain quantitative variations common to all such responses. When a muscle or gland is stimulated

by a mass discharge of energy over its associated motor nerves, it reacts suddenly, thereby causing an overt movement, or secretion of some glandular product. In the case of muscles, at least, response is roughly graded to stimulus intensity in accordance with the all-or-nothing law. If the stimulation is continued for a long time, progressive decrements in response appear. This is usually referred to as fatigue, though an equally appropriate term would be motor adaptation. The primary cause for the loss of muscular responsiveness is the rapid accumulation of split waste products, especially at the point of junction between nerve and muscle. Like all cells of the body, muscle fibers are able to carry on work by burning up certain fuels, which they manufacture from foods carried to them by the blood. When motor activity occurs too frequently, as in continued electrical stimulation of a frog's muscle over its associated motor nerve, the rate at which fuel molecules are split up by the activity exceeds the rate at which they are burned by the oxygen of the blood stream, and the toxic substances resulting from this partial combustion accumulate on the muscle and literally foul its connection with the central nervous system. This "fuse plug" arrangement operates to cut off the stimulus to continued action before the muscle fibers are seriously impaired and, during rest, when waste products are being removed and new fuels supplied, the muscle recovers its irritability.

Because much of man's work also shows decreased output with time, many psychologists have tried to explain this phenomenon on the same basis as the fatigue effects found in the nerve-muscle experiment with the frog. It is known, however, that in such work as prolonged mathematical activity, a man may show decreased output without true motor fatigue, and that true fatigue is often present without decrement of output. The latter situation is especially true when one applies progressively stronger inner stimulation to get through some arduous and monotonous task, when renewed command of the motor apparatus is apparent. Actually, both motor and sensory adaptation act to protect the central nervous system from impairment; only the fact that the central adjusters can command new sources of stimulation from the backlash of tonic reactions enables the organism to break through

these barriers when necessary and compensate for loss of phasic responsiveness.

TONIC REACTIONS

We have already indicated that phasic reaction to stimulation is of necessity superimposed upon tonic bodily trends. A vast array of motor processes comprise this organic excitation background, acting to direct sensory stimulation into specifically prepared channels of overt response and sustaining elaborate patterns of central adjuster activity. Most obvious and well-known for their energizing effect on phasic reaction are the processes of skeletal muscle tension; we often find them compensating for the deleterious influence of sleep loss and in work under distraction. Less thoroughly understood but of recognized importance are the visceral tensions and the postural changes in smooth muscle tissue; these often carry for long times the residual effects of frustrations due to a deflection of the central excitation pattern from the thwarted overt activity.

Most vital of all factors to general reactivity level are the secretions of endocrine glands, called autocoids; these are poured directly into the blood stream. Some secretions, called hormones, serve to excite while other substances, called chalones, serve to depress the activity of other glands and bodily tissues. Thus, the pituitary gland is known as the "motor" of the gonads and certain of its hormones are injected artificially to raise and lower sexual vitality. Another instance is seen in the favorable effect of the thyroid hormone on the general "drive" of patients with low metabolism. Adrenal and pancreatic gland secretions act with the autonomic nerves to raise and lower the body's general energy level; likewise other glands, and tonic muscular reactions act with the brain-stem center to maintain its vigilance.

As with our discussion of phasic reactions, we cannot treat here exhaustively the many qualitative variations in tonic activity, but shall mention only certain questions of operation which apply to all these processes. The first and most important concerns the relationship of quantity of tonic activity to the vigilance of the central nervous system. When is the brain "asleep," we may ask, and when is it in the state of excitability that is known to us as consciousness? Repeated

demonstration of the relativity of so-called mental effort and tonic motor activity leads us to assume that backlash excitation from these processes supplies a major portion of stimulation necessary for brain activity during waking hours. While final confirmation is far from complete, we may think of muscular tension and related tonic processes as supporting increasingly effective performance up to a certain point, after which more excessive reactivity is accompanied by performance of decreased effectiveness. As indicated in Fig. 4-3,

BRAIN AND BEHAVIOR

Having taken into account the operation of both receptors and effectors, we are left with the adjustor mechanisms that intervene. The primary function of these mechanisms is to integrate the various excitations coming from the receptors and to direct the effector responses with reference to stimulus conditions. In spite of their recognized importance, the control mechanisms of the brain and spinal cord are the most imperfectly known link in the total receptor-adjustor-effector sequence.

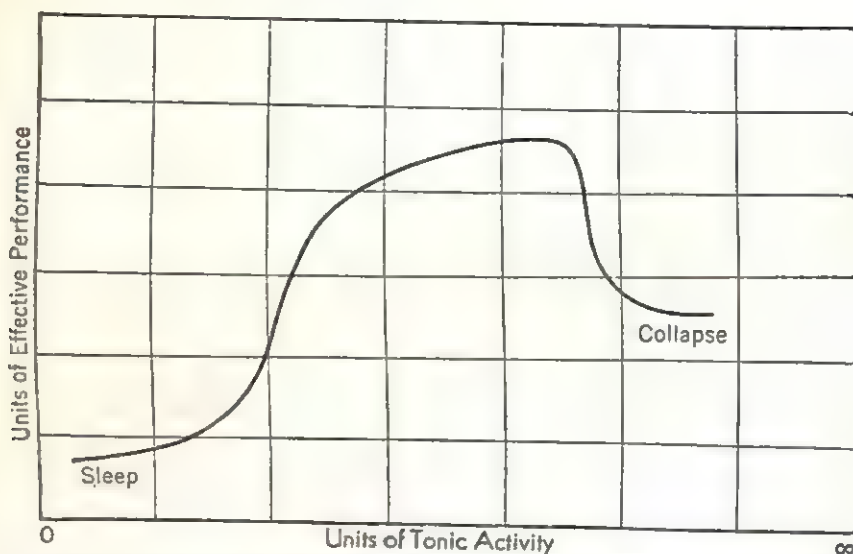


Fig. 4-3 Theoretical relation of supporting tonic activity to the effectiveness of phasic performance.

performance levels sustained by a low degree of tonic activity would be akin to sleep, whereas the upper limits of reactivity would be accompanied by the collapse of integrated behavior.

It is also known that when overt phasic activity is blocked short of its goal, the supporting tonic processes tend to persist as a heightened reactivity level and so develop an excitation pattern which exerts a more or less constant pressure to be relieved. Experiments have shown that the more successful the overt reaction to a stimulus situation, the lower the residual tensions. In this direction, possibly, lies new light on "ability to cope" in aging organisms, also on the baffling problems of neuroses. It is in these relatively untouched areas, that physiological psychology is just beginning to become aware of its potential for making contributions to psychiatry and gerontology.

Many elaborate theories of how these centers function in specific types of behavior rest upon assumed properties of nerve cells which have no basis in physiological experiment. The starting point for most of these accounts has been either the theory, dating from the phrenologist Gall, that psychological activities are localized within small brain areas, or the notion that all integrated activity is patterned after the spinal reflex. Neither of these theories is correct in fact. Gall's general idea of localization gains support from results showing definite kinds of impairment upon destruction of certain brain areas, but does not take into account many negative instances of vicarious function and gives no answer to the all-important question of how different areas exercise their functions or influence each other. Extension of the theory of reflex integration to this problem is

also unwarranted; for although many spinal reactions such as the knee jerk may be explained by the conduction of impulses from receptors to effectors over inherently restricted pathways, greater plasticity of central connection is necessary to explain the more complicated behavior patterns. No amount of subsidiary theorizing in the form of allied reflex arcs or the interplay of facilitative and inhibitory neural circuits alters the fundamentally weak assumption that particular reactions are restricted to connections of lower "resistance" between individual nerve cells.

Experimental evidence on the localization of brain function involves two types of research. Each of these types has contributed a somewhat different answer to the problem. The traditional approach consists in removal or stimulation of some general area correlated with such changes in effector or receptor activity as may be noticed. But dealing thus with a brain part in isolation is, in a sense, an artifact, and consequently the newer approach consists in taking some well-defined behavior pattern, such as a learned reaction, and correlating the different amounts of brain tissue removed with functional loss. The first approach gives a view of the special functional contributions made to the total behavior flux by grossly different anatomical structures; the second approach shows us that similar anatomical units within these gross structures are largely equipotential, that is, capable of being used in many different functional ways.

STRUCTURAL ORGANIZATION OF REACTION LEVELS

The gross divisions of the adjustor apparatus are responsible for the general form that the response takes. The same effector and receptor mechanisms function in many different types of behavior; but the structural arrangement of the central nervous system makes it an organization of levels, so that certain parts of it may dominate behavior at a given instant. For explanatory purposes a rough comparison may be drawn between neural organization and that of a commercial agency engaged in providing appropriate answers to an almost inconceivable variety of questions. In the interest of efficiency, simple and urgent messages are responded to on the ground floor level, the receiving clerks connecting directly with the sending clerks, and the news that a response has been

made reverberating to offices on higher floors. If, however, an automatic response is not immediately forthcoming, or if the response made is not entirely appropriate, the higher offices take up the task of directing the sending end of the concern. The more complicated the problem, the more work will be put upon fashioning the response. The news will be transmitted upward from floor to floor, each department supplying whatever information it can give upon the topic. The nature of the message and the ability of a department to answer it will determine where the dominant direction occurs. Only those messages that cannot be answered appropriately at the lower levels are passed to a higher floor for decision. If they do reach so far, this office is in command of all the information which has been collected by those departments below it. In the central nervous system, the cerebral hemispheres represent the highest floor, the spinal cord the lowest floor, and other brain centers the intermediate floors. Nervous impulses developed by the receptor mechanisms may thus pass through different adjustor centers to effect motor responses, and the particular loop-line connection used determines the dominant center for integration.

Fig. 4-4 indicates the major features in the structural organization of reaction levels. The spinal cord carries integrating centers for local "reflex" response to local stimulation and is, in addition, the grand artery for entrance and exit of nerve discharges to and from other adjustor centers. A structure-functional division of each of the spinal segments enables us to recognize nerve fibers entering the back, or dorsal, side of the cord as sensory and those on the front, or ventral, side as motor. Running parallel to the segments of the spinal cord are the autonomic nerve chains or ganglia which act as relay stations and independent correlation centers for smooth muscles and glands. The divisions of this part of the nervous system have opposed functions; the sympathetic ganglia serve to inhibit digestive actions and to mobilize bodily energies for emergency adjustments, as in fight or flight; and the parasympathetic division controls the bodily energies for appetitive or vegetative reactions.

The brain has three divisions: (1) the hind-brain, which comprises the medulla oblongata and the cerebellum, (2) the midbrain, and (3)

FIELDS OF PSYCHOLOGY

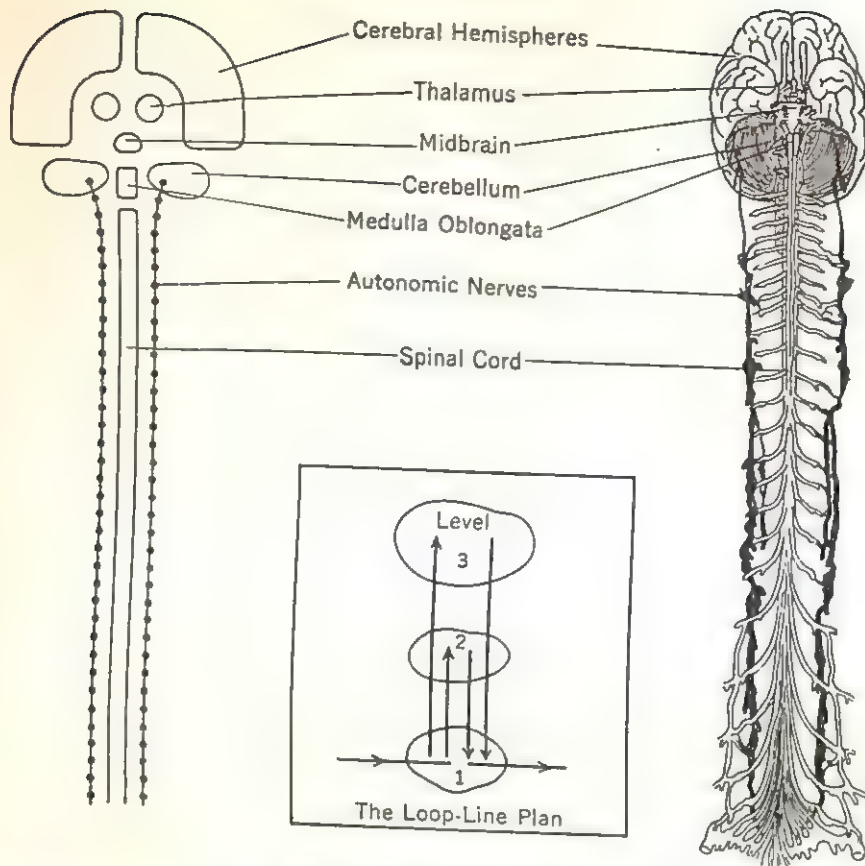


Fig. 4-4 Levels of neural integration.

the forebrain, which comprises the thalamus and the cerebral hemispheres. The medulla oblongata carries centers for regulating respiration, circulation, sleep, and satiety—automatic reactions necessary to the continuance of life. The cerebellum and the midbrain are two great coordinating centers for muscular responses, especially those of the tonic type. The thalamus is the vestibule by which sensory stimulation enters the cerebral hemispheres and is also a motor center for the regulation of certain bodily activities involved in the emergency emotions and coping behavior. The cerebral hemispheres coordinate the activity in lower centers, and specialize in directing the most complicated neuromuscular reaction patterns of perception, learning, and thought. These various brain parts have been successively superimposed upon the spinal cord. As each new structure has developed, it has established connection with the lower and more primitive centers and taken over a portion of their function. In man, the cerebral hemispheres have grown so enormously that the

outer layer or cortex is folded upon itself, forming many convolutions. This structural growth is paralleled by a degree of functional dominance over the rest of the adjustor apparatus which exists in no other species.

Certain areas of the cerebral cortex show a considerable degree of specialization, while equally large groups of cells seem to have more general facilitating and inhibiting functions. Fig. 4-5 shows the localizations roughly. The primary centers of motor control are located in front of the central fissure. At the lower end of the fissure is one of the centers of speech control and any lesion here will cause speech loss, or aphasia. The primary reception centers for stimulation from muscles and other internal tissues are in the parietal lobe, set in appropriate relation to the motor centers corresponding to these parts. The special senses also have well-defined reception areas—vision on the medial side of the occipital lobe, and hearing in the temporal lobe below the Sylvian fissure. The remaining areas, includ-

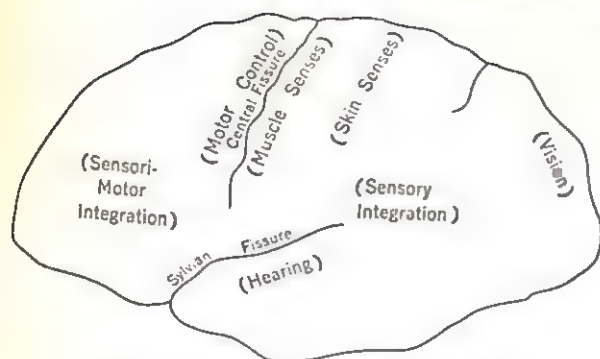


Fig. 4-5 Cortical localization of function.

ing the frontal lobe, as indicated, are generally considered integrating centers for the higher psychological field. The fact that these parts of the cerebral cortex are most adaptable and labile helps prevent a harmful stereotypy of behavior and has done much to make man ascendant over all other animals.

MASS ACTION WITHIN THE CEREBRAL CORTEX

While various neural strata may dominate different types of reactions, it is not to be inferred that individual nerve cells within a given brain part have exact functional specificity. This is especially true of the cerebral cortex, where equivalence of function reaches its highest development. The "engram" or trace of a learned reaction, so often "explained" by a lowering of the "neural bond" or "synaptic resistance" between two adjacent nerve cells, actually involves an area of considerable extent. The fact that rats, and even higher animals, show residual effects of learned habits irrespective of the particular part of the cortex removed, has always been an obstacle to conditioned-reflex theory, postulated by Pavlov to explain all higher neural activity (he had little contact with either psychological or neurological discussions after 1900).

The more complex the habit learned, the greater the difficulty experienced in establishing even the gross locus of the essential neural pattern. In general, the greater the amount of cortical tissue destroyed, independent of place, the more severe is the functional loss. The suggestion here is that the traces of previous functional activity are not laid down on the brain surface according to a strictly spatial plan, but exist as ratios of excitability involving a wide cortical territory and cell assemblies, which are capable of begin reor-

ganized in the parts remaining after brain lesion. This relatively nonspecific response of cortical cells in the control of complicated discriminative behavior is known as *mass action*, and it is probable that upon complete removal of the cerebral hemispheres or the relative functional decortication produced by a startling stimulus, the thalamic centers act somewhat similarly in fashioning the emotional type of display.

It is difficult, of course, to estimate the extent to which results obtained on the brains of the animals apply to man. In so far as quality of tissue is concerned, the results are comparable; and aside from the primary sensory reception and motor projection areas, the cortical tissue of man seems to be generally capable of mass action and equipotential function. Cases have been reported of patients who recovered from complete removal of the frontal lobe without serious intellectual impairment, except possibly some loss of inhibitions.

Present theory of how the brain acts in memory storage and recall takes as its model the switching systems and coding devices of the man-made electronic computer; but unique chemical reactions between brain cells might develop genetic replications and resonance phenomena for receiving and transmitting information even more directly. The ultimate understanding of cortical function should properly start from study of multi-variant excitability patterns, recorded by both electrical and chemical tests.

BODILY MECHANISMS AND PERSONALITY

The notion that personality traits are intimately related to structural differences of individuals has had a long and unjustified vogue. Such pseudoscientific approaches as phrenology and physiognomy are still practiced upon the unwary public, and there is much talk among certain psychiatrists of the characteristic mental disorders of special body "types."

Before we examine the evidence on this problem, it is well to recognize that psychological tests are only beginning to give us valid and reliable criteria for detection of different aspects or traits of personality. Until fairly recently, estimates of relative intellectual ability rested upon nothing more substantial than the opinions of the persons

making the concomitant structural measurements; and even now we find gross system-classifications of abnormal behavior substituted for continuously graded tests of the emotional or nonintellectual aspects of personality. With this state of affairs on the psychological side, and with the difficulty of making complete anatomical and physiological assays on a sufficiently large sample of the population, it is small wonder that few definite relationships have been found. With the balance of evidence definitely negative in reference to an intimate connection between physique and personality, a few suggestive reports show that more subtle physiological variations are probably involved.

THE PSYCHOANATOMY OF TYPES

The psychoanatomy of types assumes that men can be pigeonholed into several rough divisions according to their general structural development and that these divisions will correspond, also roughly, to fundamental differences in temperament and intelligence. This notion can be traced as far back as Hippocrates, and contributions since that time have been chiefly the substitution of more exact physical measurements without a corresponding increase in their significance. Height, weight, carpal development, height-weight ratios, head shape, and relation of limb to trunk development have all been tried and found wanting. For example, tendencies to extroversion or introversion may have constitutional differences in arousal pattern as their base and it is even possible the neurotic personality will someday be seen not so much a creature of unfortunate environmental circumstance but as a bodily system deficient in ability to discharge heavy stressful stimulation. We definitely know that the correlations between height-weight ratios and tested intelligence on the average are so small ($+ .28$) normal individuals of extreme limits in size may show almost any degree of intelligence from high to low; and the slight relation reported between body type and emotional disorders provides no basis for individual prediction. We can see, therefore, that the only possible connection between physique and personality would have to come from some common determining factor, such as the endocrine glands; and only in extreme cases, as in the thyroid deficiency of cretins, could we expect an obvious relation. It is difficult to see

why in the face of such low correlations as have been found, the psychoanatomy of types is still so well received. The automobile mechanic is not misled even by a high apparent correlation between body build and engine power, but directs his attention to the essential physical correlates of power or how much load the system can carry without breakdown. It would be sensible to adopt a similar attitude with reference to man.

NEUROANATOMICAL DIFFERENTIATION

Numerous attempts have been made to correlate the intellectual aspects of personality with differences in neural structure; but no postmortem method of assorting brains on the basis of weight, size number of convolutions, or thickness of the cortical layer has yet served to classify them as to previous functional capacity. The 6 per cent difference in brain weight between men and women disappears when corrected for the proportionally heavier bodyweight of men and so constitutes no evidence of superior function. Widely quoted surveys of the brains of "geniuses" have little or no statistical reliability. Whereas absence of large amounts of cortical tissue certainly lessens capacity to learn, the brains of superior human beings probably have not only an extensive mass of tissue but are also very highly organized. A complicating factor in all of these studies is the uncertainty as to what part of a given brain was once functionally active, and what portion was inactive tissue, serving merely to support and protect the active parts. There is great need for more delicate and refined techniques of differentiating brains, and it is here that brain chemistry—with its assay of the products of cell activity—may prove very useful. At present we can only surmise that it is neither the amount of cortical tissue nor the quantity of energy available which alone accounts for the abilities of man, but rather differences in the capacity of brain structures to make efficient use of the bodily energies as well.

PHYSIOLOGICAL DIFFERENTIATION

For many aspects of personality, especially the so-called temperamental traits, it now seems that such bodily bases as exist are more likely to be revealed by physiological analysis of behavior than by attempted correlations with either gross or microscopic anatomical structures. Measurable

variations that are probably important to this problem include metabolic rate, blood pressure, electrical skin resistance, muscular tension, and the acidity of the blood, urine, and saliva. Differences in the hormone content of the blood undoubtedly have even greater significance, but biochemical assay is hardly ready for such a complicated field of research.

It is difficult, as yet, to say exactly what these various physiological measures indicate in terms of general organic reactivity or of differential body chemistry. Individuals rated as "neurotic" or "lacking in emotional stability" show high variability and slow recovery of equilibrium in skin electrical resistance measures taken during displacing stimulation. On the other hand, attempts to relate such results to specific glandular or muscular conditions have not been generally successful.

It is true that quieting drugs have revolutionized the treatment of insane patients. Such information makes it easy to assume that every person has a physiological "Plimsoll mark" beyond which his system may not be loaded without causing psychophysiological breakdown or to be led into further abortive speculations. Thus, one writer foretells the day when "the physician will have bottled hormones labeled *happiness*," and "millions will make the psychiatric cot a dead spot." Such seductive verbalism minimizes the tremendous obstacles which are yet to be surmounted, and actually hampers study of the precise relationships between endocrine activity and total behavior.

CONCLUSION

One cannot review the problems of physiological psychology without being impressed by the magnitude of the task remaining to be accomplished. Much of the work mentioned in this chapter has been negative, serving mainly to sweep away old and false notions. On the other hand, the new lines of attack which are developing hold tremendous promise for the more refined prediction and control of human behavior. Students in-

terested in detailed information on the topics covered should consult the selected references given below. From such books, even more than from this introductory account, the inseparable linkage of psychology and physiology becomes increasingly clear. For example, gastric ulcers are now seen as related to frustrations of behavior, while surgical removal of brain parts and chemical drug treatments are being successfully prescribed for disorders which would formerly have received only a "mental" treatment. The psychosomatic approach to abnormal behavior is one of the most promising frontiers of present-day science. Its development is ready and open to laboratory and clinical workers who are trained conjointly in psychology and physiology.

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PART III: Special Fields

CHAPTER 5

Animal Psychology

WHY STUDY ANIMAL BEHAVIOR?

The traditional reference to man as a rational animal as the major basis for distinguishing *Homo sapiens* from subhuman forms will no longer hold up. Evidence from several disciplines, including psychology, suggests that the symbolizing process is the key to human as distinct from animal behavior. By the ability to symbolize we mean the usage of language and other cultural media as distinct from communicating via signs. For example, while it is true that a dog may be conditioned to respond to a certain verbal command, it is not true that dogs, or other subhuman forms, comprehend words in the abstract sense, and it is certainly the case that no animal below man has developed a language or other means for passing on a culture from one generation to the next. Although rats and monkeys are able to think, and parrots talk, and the birds and the bees communicate, and the ants live according to a highly structured society, no animal species except man has developed the symbolic form of behavior. The most intelligent monkey or baboon has not yet developed a calculus, or written a sonata, or demonstrated a religious concern. In short, lower organisms are clearly highly adaptable and intelligent, but their symbolizing capabilities are so primitive that it is safe to conclude that the differences in performance level reflect a qualitative jump between other animals and man.

Perhaps the observation most relevant to this conclusion is to be found in a study by Wolfe (1936). In this study Wolfe showed that chimpanzees learned to use different colored poker chips in order to acquire a variety of food rewards. If the chimp, for example, preferred a banana, he would turn in five blue chips for one red one, slide it into the banana dispensing machine, and get his reward. In other words,

* The writer wishes to acknowledge the assistance he has received from Dr. W. A. S. Smith in preparing the section on experimental abnormal behavior. He is similarly indebted to Mr. Barry Mackay for general assistance, and for special assistance in preparing the material on the evolution of vision and locomotion.

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up to a point, we can say that Wolfe's chimps placed values on tokens in much the same manner as the human evaluates money in making a variety of purchases. Wolfe and other animal psychologists claim that this type of experiment constitutes proof for the involvement of symbolic processes in the subhuman primate. The writer would agree with this in the rational-cognitive sense, but not in the meaning-affective-cultural sense which the symbolization process implies. That is, he is inclined to evaluate the experiment cited as more of a demonstration of the problem-solving capacity of the chimp than to see it as a manifestation of the chimp as potential poet, artist, or creator of a primate culture. Of course the problem-solving ability of subhuman primates, as demonstrated in the researches which have emanated from such centers as Harry Harlow's Primate Laboratory at the University of Wisconsin and the Yerkes Laboratories of Primate Psychobiology, is quite advanced. They are capable, for example, of categorizing, that is, of performing a type of simple taxonomic classification of a variety of objects. The performance of the rhesus monkey in the manipulation of a series of rakes as simulated tools would rarely be surpassed by human infants of comparable age. In this connection psychologists have actually reared chimpanzees along with their own children, and have demonstrated that the chimp surpasses the child at certain ages and in some types of mental ability. Of course the chimp has a much shorter life span than the human, and when one corrects for maturity level rather than comparing on the basis of absolute age, the child is superior to the chimp. Estimates have been made, however, that certain individual subhuman primates can perform at a human mental age level of around six or seven. While subhuman problem solving is most convincingly demonstrable at the primate level, there is also evidence that animals much lower in the animal kingdom exhibit ability to reason. Numerous experiments have shown this in the dog and the cat, and N. R. F. Maier (1929) has even shown it to be true of the rat! Similar evidence at lower levels gets confounded with the semantic difficulties of what one means by reasoning.

What is the point of this discourse on the animal as thinker and man as symbolizer? Primarily to establish a base line for the study of animal behavior, to make it clear that because

of the continuities between animal and man (e.g. the learning and thinking process) we can expect to learn a great deal about the laws which govern human behavior as a result of studying simpler animal forms; but, at the same time, because of the discontinuities between man and animal (e.g. the use of symbol systems which lead to cultures and civilizations), we cannot expect to learn *all* about the laws which govern human behavior by such study. Thus, a theory of behavior based *only* on animal observations would, by definition, be dehumanized and incomplete. In short, the overall relevance of animal psychology to human psychology is that it provides us with the biological or animal baseline before we add the cultural and social overlay of the symbol.¹

THE APPROACH OF THIS CHAPTER

The breadth of coverage implied by the title of this chapter is so great that it would be impossible to do justice to the area in the limited space available, for it is synonymous with general psychology. One could attempt such a broad coverage with focus on methods and a variety of animal forms, but the results of such efforts are usually superficial. If a true comparative psychology² existed, this would be the preferred method of treatment because a taxonomic classificatory scheme provides us with an appropriate theoretical framework. But unfortunately psychologists have thoroughly sampled only a handful (e.g. worm, fish, pigeon, mouse, rat, cat, dog, monkey) of the million species available for study. Furthermore, psychologists have found it difficult to conceptualize units of behavior in such a way as to

¹ Psychologists have been surprisingly mute on a subject of such obvious importance to the understanding of man. For a recent exposition of the relevance of the symbol to the study of behavior see the volume edited by Royce (1965).

² Because of the limited observations available throughout all fourteen phyla of the animal kingdom very few efforts have been made to present a true comparative psychology. There are many books which carry the word comparative in the title, but they do not, in fact, reflect phylogenetic comparisons in the same manner as will be found in the sister fields of comparative anatomy and comparative physiology. The two most complete efforts of this type are the three volumes of Warden, Jenkins and Warner (1935, 1936, 1940), and Maier and Schneirla (1935). Two recent efforts include C. J. Herrick (1956) and A. Roe and G. G. Simpson (1958).

meet the methodological requirements of interspecies comparisons.

Such substantive and methodological limitations necessarily rule out the general psychology and comparative psychology approaches, leaving us with a selective-sampling approach. That is, we shall sample from the entire range of animal behavior, but we shall select a few topics for detailed analysis on the basis of uniqueness to animal psychology. For example, behavior genetics can be studied much more effectively with animal subjects than it can with human subjects. The factors of environmental control and life span are the most obvious experimental issues in a problem area such as this. If we are to attribute causation to the genotype rather than variables in the environment it should be obvious that such an inference would be possible only under conditions of maximum control such as in the laboratory. Furthermore, the necessity for inbreeding, cross breeding, testing of many *S*'s (*S* stands for subject) at maturity, etc., make it impractical to manipulate human *S*'s experimentally. Another case in point, but for a different reason, is experimental research on psychopathology. The essential questions we are asking here are "How did this organism get this way?" and "How can we return the organism to a normal state?" It seems clear that the purposeful, artificial attempt to produce an abnormal condition in a subject, particularly if this is being attempted for the first time, is fraught with unpredictable outcomes, including the possibility of death or other irreversible consequences. The ethical issues involved in conducting such studies on human *S*'s, even if they volunteer, are obvious. This is just one of many examples³ of important research which psychologists must, of necessity, conduct on animal *S*'s rather than human *S*'s, at least in the initial stages of inquiry.

We shall also take a look at comparative psychology and psychological theory. In the case of the former problem, the hope is that we can at

least get a glimpse at what the comparative scientist is trying to do. Knowledge about the evolution of behavior is bound to have an effect on our perspective of man. The justification for taking a look at theory is that the bulk of animal research to date has been conducted in the name of theory. The argument has been that it will take centuries before we will know enough to piece together an adequate theory of human behavior, especially if we conduct our studies on human *S*'s. The suggestion is that we purposely over-simplify by studying a less complex organism such as the rat in order to get leverage on a behavior system which can be elaborated later when it is extended to man. The fact of the matter is that our most viable theories of learning have been evolved on this basis.

METHODOLOGICAL-TACTICAL ADVANTAGES OF ANIMAL STUDY

GREATER CONTROL OF EXPERIMENTAL CONDITIONS

The student of animal behavior turns to animal subjects for a variety of reasons which have to do with the solution of a particular scientific problem. One consideration which is common to all such problems, however, is the fact that the investigator who uses animal rather than human subjects can exert greater control over the experimental conditions. For example, he can expose all *S*'s to exactly the same environmental conditions, not only during the course of the experiment, but throughout the life span. If it is important, as in the case of psychogenetic research, he can even control conditions before birth, such as equating the genetic constitution of all *S*'s in the sample under study. He can control dietary inputs; motivational determinants, such as water deprivation; sensory inputs, such as amount of light or sound; the internal environment, via pharmacological injections, surgery, and the like. In short, the animal subject is simply available in a way which is impossible for human subjects.

EXPERIMENTALLY IMPORTANT CHARACTERISTICS OF A PARTICULAR SPECIES

The psychologist may also turn to animal subjects because of the relative simplicity or other special characteristics of a particular animal form.

³ See Chap. 4 for more examples. The author is pointedly avoiding extensive references to physiological psychology as this material will be covered in the chapter by Freeman. It should be obvious that this artificial separation of comparative and physiological psychology is simply a matter of convenience in allowing for a reasonably appropriate division of labor. However, in the present context this constitutes another limitation on the approach of this chapter.

A good knowledge of the special anatomical or physiological characteristics of a wide variety of species is extremely important in the study of animal behavior. Only this kind of information will lead the investigator to the most appropriate animal for a given problem. For example, suppose we are interested in trying to determine the extent to which either a brain or a nervous system is required in order to elicit a conditioned response. Since it has only a very primitive brain, the earthworm would be an appropriate animal to include in testing for the first part of the question. And since the amoeba is essentially a glob of protoplasm, it would be relevant to the second part of the question. The answer seems to be that neither a brain nor a nervous system is necessary for conditioning. It is more efficient with more organized nervous structures, but all that is necessary is some medium of conductivity. Single-celled animals have been conditioned after hundreds of training trials, and worms have been trained to make the proper choice in a simple T maze in about 150 trials. Because of their simple, ladder-like nervous system, with a tiny control center at the head end, worms have also been sectioned vertically and horizontally to check on the relationship between neural structure and initial learning, and the retention of previous conditioning of the separate halves after sectioning (all halves learn under all conditions). Similarly, army ants are of particular interest in the study of the communal form of social organization, bats and porpoises in the study of echolocation, and dogs, mice, and *Drosophila* if one wishes to relate genes to behavior.

RELATIVELY SHORT LIFE SPAN OF SUB-HUMAN ANIMALS

Two examples of psychological research where the availability of subjects with a short life span is of crucial importance are developmental studies and studies of inheritance. Critical period and early experience studies, for example, require experimental intervention early in the life span, followed by analysis of the effects of such intervention at a later stage of the developmental process. J. McV. Hunt (1941), in his study of the influence of feeding frustration in infancy upon the behavior of the adult, used the rat because of its brief life cycle. Incidentally, he found that the

frustrated animals, when tested in adulthood, hoarded twice as many pellets as their litter-mate controls. Tryon's (1940) twenty-year study of bright and dull strains of rats involved twenty generations (equivalent to 600 years in terms of the human life span) of selective breeding. Leaving aside other considerations, the issue of time alone makes it mandatory that animal subjects be used by the student who wishes to investigate inheritance experimentally.

ETHICAL CONSIDERATIONS PROHIBIT USE OF HUMAN SUBJECTS IN CERTAIN AREAS OF RESEARCH

The psychologist may turn to animal subjects, not because of an intrinsic interest in a particular animal, or because the animal is especially appropriate for a given problem, but because ethical considerations dictate that he simply cannot investigate certain questions by way of human subjects. Experimental studies on the relationship between brain damage and learning is an obvious case in point. Investigations on strength of drives, involving extreme deprivation of food or water, constitute additional examples. Drug studies, the experimental induction of neurosis, the artificial crossing of the optic nerve-occipital cortex connections, the setting up of experimental social communities from birth, all involve procedures which could endanger the lives of human subjects and must, therefore, be pursued with animal subjects. Thus, while his ultimate interest is usually focused on understanding man and his behavior, the animal psychologist finds that the longest way around is sometimes the only way to reach the goal.

BEHAVIOR GENETICS

This section is concerned with the variability of behavior, with the focus on hereditary as opposed to environmental determinants of such variation. The last two decades of research on the nature-nurture controversy have succeeded in dispelling the idea that a given behavior pattern is either wholly learned or wholly unlearned, environmental or hereditary. Instead, the problem is now seen in terms of assessing the proportion of behavioral variability which is attributable to genetic and non-genetic sources of variation, plus genetic-environmental interaction effects. Thus, while it

is recognized that both genetic and environmental factors influence all behavior, it is our present intent to focus our attention on those aspects of behavior in which the hereditary influence has been shown to be primary.

Since behavior as such has no physical or material form, and since the reproductive process occurs via relatively simple chemical structures or genes, it follows that only some kind of physical structure rather than behavior per se can be transmitted from one generation to the next. That is, some kind of bodily structure, substance, or mechanism must, of necessity, intervene between the genotype and the behavioral phenotype.⁴ Examples are the inheritance of a complex nervous system rather than intelligent behavior, the inheritance of hormonal glands which secrete adrenalin rather than the inheritance of emotional behavior, and the inheritance of a complex photochemical visual system rather than visual-perceptual behavior. Note, however, that psychogenetic studies as such do not necessarily have to demonstrate such structural or material differences, even though it is understood they are there. All that is required at the behavioral level is a demonstration of the fact that the observed differences in behavior agree with the predictions implicit in the genetic analysis. The obvious point is that differences in these bodily structures, substances, or mechanisms are dependent upon different genotypes on the one hand, and further, that such differences provide the biological basis for differences in behavior. Thus, there is a correlation between the genotype, the bodily mechanism, and behavior. When this correlation is high, that is, when there is complete isomorphism between genotype and both the biological and behavioral phenotypical expressions of the underlying genotypes, then we refer to such essentially unmodifiable behaviors as instinctive or innate. Such primarily gene-determined behaviors are particularly characteristic of sub-mammalian

⁴ Genotype refers to the number and type of genes in the nucleus of each cell. Phenotype refers to the appearance or expression of the underlying genotype. The gene is a biochemical unit (DNA) which determines the subsequent structure and functioning of all biological species. Hair color, eye color, height, and various behavioral traits are examples of the phenotypical structures and functions the underlying genotype can produce.

forms, and have received considerable study by a group of zoologists known as ethologists. We will look more closely at these findings under the heading of interspecies differences.⁵

In terms of traditional genetic-evolutionary theory the ethological studies are focused on species as opposed to individual adaptation. That is, species-specific behaviors, such as instincts, make biological sense because they perpetuate the species. However, when we ascend the phyletic series, where the inherited biological structure is organized for modifiability (e.g. the central nervous system of man and other primates, as opposed to the nervous structures of the insect phylum) rather than stereotypy, then it is obvious that a complete genetic-behavioral isomorphism will no longer hold. In such cases, while the influence of heredity still clearly prevails, it is equally clear that the observed behavior will be much more variable. We shall look at cases such as these, where the genotype puts limits on the variability of behavior, in sections labeled intraspecies and individual differences.

INTERSPECIES DIFFERENCES

Taxonomic studies of comparative anatomy and comparative physiology, in combination with genetic analysis, leave us with no doubt concerning the hereditary basis for the observed variability between various phyla and species. But can we make the same claim for behavior? That is, what is the evidence regarding heredity as the basis for species differences in behavior? To what extent is man's behavior gene determined, for example? And does it go beyond the level of instinctive behavior? Unfortunately research to date is insufficient to provide complete answers to these questions, although there has been a resurgence of interest in psychogenetics during the past two decades. Let us briefly summarize the research of the ethologists⁶ on instinct as one important source of relevant knowledge.

⁵ When we observe similar stereotyped behavior patterns somewhat later in the life span of the organism, we refer to such behavior as maturation, still primarily gene-determined and highly isomorphic, but requiring more time to manifest itself.

⁶ For a brief summary of their work see E. H. Hess (1962). For greater detail see the writings of Tinbergen (e.g., 1951) or Lorenz (e.g., 1953), or the recent book of Thorpe (1956).

We begin with the common observation that certain complex, stereotyped patterns of motor behavior, such as nest building in birds, web spinning by spiders, homing of pigeons, migration of fish, and mating behavior, each of which is characteristic of all members of the species, either occur without the necessity of learning or with learning contributing minimally to the total variance. This point has been demonstrated repeatedly in isolation or deprivation experiments, where an animal of the species exhibits the appropriate behavior pattern in spite of the fact that there was no possible way for him to practice or to imitate. Squirrels, for example, reared in isolation and deprived of the opportunity to handle objects of any sort, will try to bury nuts or nut-like objects on a hard surface floor upon their first exposure to the test situation. The fact, then, that certain species exhibit certain instinctive or fixed behavior patterns, seems well-established. Furthermore, it is presumed that the patterning of such behavior is gene determined, via the activation of an underlying physiological mechanism, such as a portion of the central nervous system. The theory is that such behavior is pre-programmed, or built into the special structuring or functioning of the nervous system, and that such nervous tissue is merely activated by stimuli known as releasers. Only certain specific, select stimuli are capable of releasing a given behavior pattern; furthermore, a given releaser activates only *one* reaction, and it does so in a robot-like rather than in an insightful manner. For example, von Uexküll has described the blood-sucking behavior of the common tick as dependent upon the odor of butyric acid. No other stimulus, such as sight of prey, will set off the attaching-to-the-host response. Furthermore, no discrimination is possible once the releaser has activated the innate releasing mechanism. If you present butyric acid to the tick on a twig or a piece of metal, for example, the tick will attach itself to the wood or metal and attempt to suck blood. Since the exact nature of the innate releasing mechanism is usually not known, it has been postulated that the releasing mechanism removes an inhibitory process when the right releaser activates the organism. The implication is that the underlying biological structure, with its attendant isomorphic or fixed behavior pattern, is ready to react and, in fact, will react in prescribed fashion any time the releaser removes the inhibitory block.

Tinbergen's study of the courtship behavior of the three-spined stickleback is an example of a chain of reactions, where each animal's previous behavior serves as a releaser for the subsequent behavior, finally ending in fertilization of the eggs. At a certain critical period the appearance of the female results in a zigzag dance on the part of the male fish. The female's reaction is to follow him. The male stickleback reacts by showing the female the entrance to the courting nest, the female enters, he touches her tail with a characteristic quivering motion, she lays the eggs and swims out, and then he fertilizes the eggs. An incorrect stimulus sign or releaser at any stage would interrupt the continuity of the chain reaction. The complexity of behavior which such linkage permits is consistent with the adaptive function which such behavior obviously provides the species.

The concept of critical period and the interruption of a chain reaction brings up the phenomenon of imprinting. Imprinting refers to an early experience which has a profound effect on later behavior.



Fig. 5-1 Dr. Konrad Lorenz demonstrates the following reaction in a flock of greylag goslings. These birds can be socialized or "imprinted" so that they follow a human being rather than the natural mother. The experimenter must make contact with the young birds shortly after hatching and before they are allowed to see adult geese. (Thomas D. McAvoy, courtesy of Life Magazine 1955 Time Inc., as reproduced in Scott, 1958, p. 148.)

The now classic example of imprinting can best be reviewed by reference to Fig. 5-1. In the normal course of events the first moving object the gosling sees immediately after birth is the mother goose. This will result in the gosling following its natural parent. However, if at the critical moment, we accidentally or artificially substitute another object for the mother goose, the gosling will follow the surrogate object. The surrogate can be any other moving object; animate, such as a bird of a different species; or human, such as Dr. Lorenz; or inanimate, such as a boat. In the case of the following behavior of the young goose the critical period lasts for only a few hours immediately after birth, but this period clearly varies with the species and the behavior in question. Hess, for example, shows thirteen to sixteen hours as the critical period for imprinting-following behavior in the duck (see Fig. 5-2).

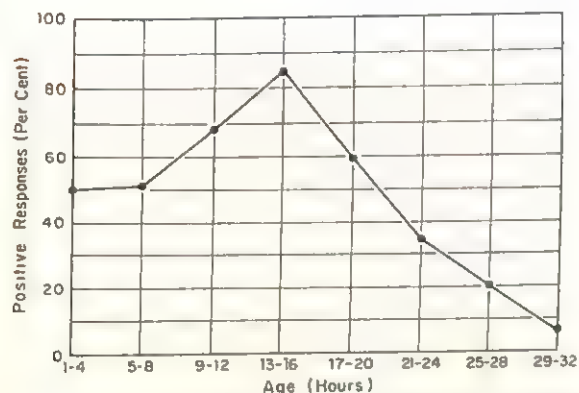


Fig. 5-2 The critical period in which ducklings are most easily imprinted is demonstrated by this graph, which shows the mean test scores made by ducklings in each group that had been imprinted at different ages, calculated in hours from the time of hatching. (From Hess, 1959, "Imprinting," *Science*, Vol. 130, 17 July 1959, p. 135.)

Imprinting is an extremely interesting phenomenon, because it does not fit the usual characteristics of either instinctive or learned behavior, thereby pointing up the necessity for viewing *all* behavior as dependent upon both genetic and environmental determinants. The environmental contribution to imprinting is evident by the fact that it is possible to substitute releasers which will activate the innate releasing mechanism. The genetic contribution to imprinting is evident in the

fixedness of behavior regardless of releaser, combined with the species-wide manifestation of the critical period.

Eventually it will be necessary to present greater details of the precise genetic events which are taking place in the case of innately determined behavior. For example, a recent study by Dilger (1962) brings out the gene-behavior isomorphism fairly clearly. Dilger investigated the nest building behavior of two species of parrot. One species carries in its bill strips of paper or leaves for the building of nests. The other species tucks such nest-building strips under the feathers of the lower back. The sequence of inherited movements in each case has been studied in considerable detail. The intermediate movements of the F_1 hybrids reflect a dramatic demonstration of the heritability of the behavior in question, for these animals clearly display a conflict between the tendency to carry nest building material in the bill and to tuck such material under the feathers.

INTRASPECIES DIFFERENCES

Most of the between-species research to date has been non-experimental and phylogenetic rather than laboratory-genetic in mode of attack. During the last decade, however, there has been an impressive increase in the laboratory investigation of strain differences in behavior (e.g., see Fuller & Thompson, 1960).⁷ The analysis of behavioral differences in highly inbred strains of animals lends itself more readily to experimental treatment because of the greater control this procedure gives us over the composition of the genotype. That is, inbreeding, or the mating of animals more closely related than the average, increases the probability that offspring will inherit the same genes from both parents. If continued long enough, for example for thirty generations via brother-sister mating, it is safe to conclude that one has generated the equivalent of a batch of monozygotic twins. The effect of inbreeding on homozygosity is summarized in Fig. 5-3. If we

Strain and breed difference studies have pretty well replaced selective breeding studies, which involve mating high performers with high performers to produce one strain, and low performers to low performers to produce another strain. For more details on selective breeding see Fuller and Thompson (1960) and see Tryon's (1940) classic study of "bright" and "dull" rats.

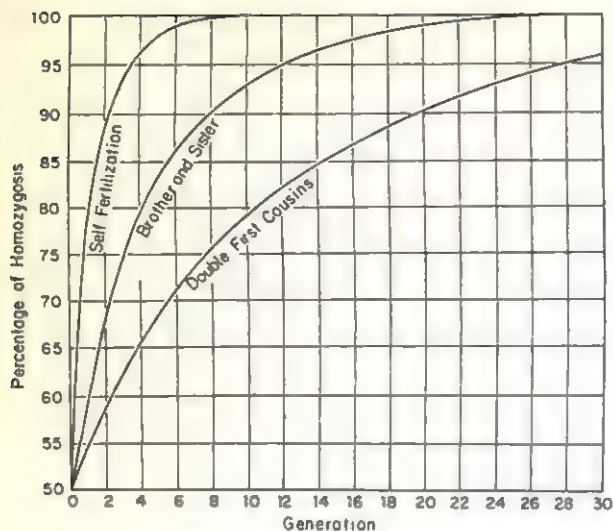


Fig. 5-3 The percentage of homozygosity in successive generations under three different systems of inbreeding. (From Russell, 1941, as reproduced in Fuller & Thompson, 1960, p. 82.)

take the following formula as an expression of total variability, it follows that the availability of

$$\begin{aligned} \sigma_T^2 &= \sigma_H^2 \\ (\text{total variance}) &= (\text{genetic variance}) \\ &\quad + \sigma_E^2 + \sigma_{HE}^2 \\ &\quad + (\text{environmental variance}) + (\text{interaction variance}) \end{aligned} \quad (1)$$

homozygous samples of animals, reared under the same environmental conditions, renders the two right-hand terms σ_E^2 and σ_{HE}^2 equal to zero. This means that the observed behavioral variability (hereafter referred to as the behavioral phenotype) is entirely attributable to the differences in genotype which exist in the several homozygous strains.

We have now introduced three terms, homozygosity, phenotype, and genotype, which can best be clarified by a brief exposition of the elements of genetic theory. Let us begin with a review of traditional Mendelian genetics, which is focused on the effect of a single gene (the genotype), the appearance of the trait or characteristic in question (the phenotype), and dominant and recessive genes. If we take eye color as the phenotype, designating brown eyes by the dominant symbol B , and blue eyes by the recessive symbol b , assuming homozygosity (i.e., sameness of all genes) for

the trait in question in each parent, we have the following familiar results:

Parental Generation	Parents of Either Sex	
Phenotype	Brown	Blue
Genotype	B/B	b/b
Gametes produced	B	b
F ₁ Generation		
Phenotype	Brown	Brown
Genotype	B/b	B/b
Gametes produced	$\frac{1}{2}B : \frac{1}{2}b$	$\frac{1}{2}B : \frac{1}{2}b$
F ₂ Generation		
Phenotype	$\frac{3}{4}$ Brown	$\frac{1}{4}$ Blue
Genotype	$\frac{1}{4}B/B : \frac{1}{2}B/b$	$\frac{1}{4}bb$
Gametes produced	$\frac{1}{2}B : \frac{1}{4}b$	b

Here we have the well-known 1:2:1 ratio in the genotype of the F₂ generation which, because of the dominance of brown over blue eye color, manifests itself in a 3:1 ratio in the phenotype (i.e., three brown-eyed offspring for each blue-eyed offspring).

Single gene effects are limited to discrete or dichotomous characteristics such as eye color and coat color. Psychological characteristics, especially at the human level, are rarely limited to two categories of expression. They are usually graded or continuous in expression, with the modal expression usually at the center of the distribution—hence the normal probability function applies to such traits. In short, behavioral phenotypes are more likely to be accounted for on the basis of what is known as quantitative inheritance. This model simply says that many genes rather than one contribute to the phenotype. The operation of such a polygenic system, and the resulting normal curve, and statistical analysis in terms of the mean and variance, can be clarified by reference to Fig. 5-4 below. In this example we have arbitrarily limited the number of contributing genes to two in order to simplify the computational work. The dominant (capital letter) form of the gene will symbolize a positive genetic effect (a *plus* gene) on the trait in question; the recessive (small letter) represents a *neutral* or no-effect gene. We begin with homozygous parents, $AABB$, and $aabb$, in the parental generation and emerge with the hybrids $AaBb$ in the F₁ generation. Since all F₁ offspring are hybrid and since all dominant gene forms contribute one genetic unit to the trait

in question, and all recessive gene forms are neutral (i.e., contribute nothing to the trait in question), the mean score for the F_1 generation is two. Furthermore, since *all* offspring have exactly the same genotype there is no variability, hence σ^2 (or variance) equals zero. But, when we mix all possible permutations and combinations of F_1 gene pairs, we increase genetic variability in the manner summarized in Fig. 5-4. Whereas the F_1 distribu-

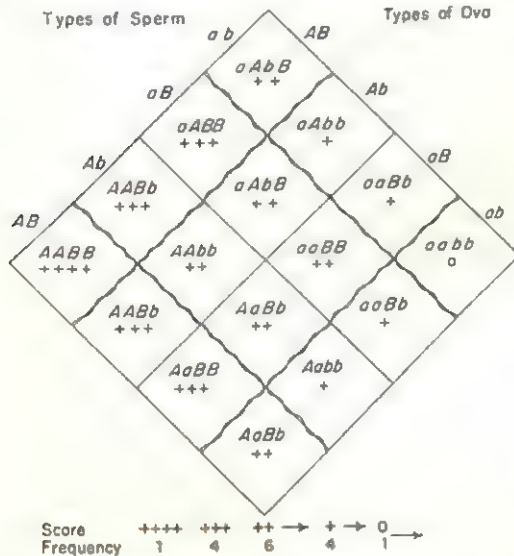


Fig. 5-4 Simplified model of polygenic quantitative inheritance in an F_2 hybrid between two pure breeding strains. (From Fuller & Thompson, 1960, p. 333.)

tion reflects sixteen cases with a phenotype score of two (i.e., the average number of pluses), the F_2 distribution shows sixteen cases distributed as indicated at the bottom of Fig. 5-4. The important point is that we have an increase in phenotypic variability (ranging from a score of 0 to a score of 6) which is due to the genotypic variability indicated in Fig. 5-4. Such continuous variability is characteristic of polygenic systems; it is not characteristic of single gene effects.

The example of strain differences in frequency of audiogenic seizures points up how the behavior geneticist attempts to isolate gene effects, particularly on the issue of single-gene versus polygene systems. Early claims had suggested that the underlying genotype for DBA (stands for dilute brown agouti, the coat color of an inbred mouse strain) audiogenic seizures was due to a single dominant gene. J. L. Fuller pressed the

genetic analysis beyond the F_2 generation to include backcrosses to the parental generation. This procedure constitutes a more stringent test for the single dominant gene hypothesis. His analysis was consistent with previous analyses which had been conducted as far as the F_2 generation, namely that DBA mice exhibited typical convulsive behavior when over-stimulated by the sound of a high-pitched bell, that $C_{57}B1$ mice did not convulse when placed in the same situation, and that hybrids convulsed in numbers sufficiently close to the predictions as to render the single gene hypothesis feasible. According to single dominant gene theory, the following findings should hold in this case:

First Backcross (Bx_1)

	F_1 crossed with P_1 (DBA)
Genotypes of Parents	Aa AA
Gametes	$\frac{1}{2}A, \frac{1}{2}a$ A
Genotypes of Offspring	$\frac{1}{2}AA, \frac{1}{2}Aa$
Phenotypes of Offspring	All susceptible to seizure

Second Backcross (Bx_2)

	F_1 crossed with P_2 ($C_{57}B1$)
Genotypes of Parents	Aa aa
Gametes	$\frac{1}{2}A, \frac{1}{2}a$ a
Genotypes of Offspring	$\frac{1}{2}Aa, \frac{1}{2}aa$
Phenotypes of Offspring	Half susceptible, half resistant

But Fuller actually reported the following observations. The deviations of the observed from the

TABLE 5-1

Inheritance of audiogenic seizure susceptibility in mice (From Waters, et al., *Principles of Comparative Psychology*, p. 333. Copyright 1960, McGraw-Hill Book Co. Used by permission.)

Group	Total N	Observed convulse	Observed resist	Calculated convulse	Calculated resist	χ^2
DBA	95	94	1	95	0	
$C_{57}BL$	50	0	50	0	50	
F_1	73	58	15	73	0	
F_2	112	66	46	84	28	13.41
Bx_1	191	175	16	191	0	
Bx_2	151	35	116	75.5	75.5	43.7

theoretically predicted frequencies were so great (see the rows labeled F_2 and Bx_2) that it was necessary to reject the single gene hypothesis. The

implication is that there are several genes involved in the system, and that further analysis (i.e., quantitative or polygenic analysis), along the lines indicated above, will be required.⁸

Most of the behavioral research to date has focused on the demonstration of strain differences. The most widely used species has been the mouse, with considerable evidence also available on the rat and the dog, and a few studies reported involving *Drosophila*. The *Drosophila* studies have been confined to relatively simple behaviors, such as phototaxis (movement toward a light source). Because of the obvious genetic advantages which accompany the use of this species, we can anticipate more precise analysis of underlying gene mechanisms. However, whether the fly exhibits behavior of sufficient complexity to correlate with polygenic systems remains to be seen. In the

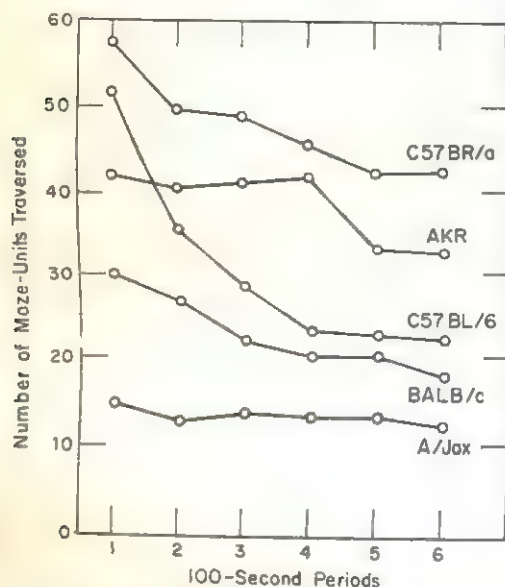


Fig. 5-5 Activity levels of five inbred mouse strains as functions of time. (From G. D. Snell, ed., *Biology of the Laboratory Mouse*, Dover, 1941, p. 329.)

meantime, we can continue to look to present studies on rodents and carnivores for such pursuits. Such studies have involved the demonstra-

⁸ See a standard text such as Falconer (1960) for additional details. See also the recent article by Broadhurst and Jinks (1961) for practical suggestions regarding procedures (e.g. the diallele cross method) of greatest relevance to the study of behavior. Advanced methods of analysis, such as those proposed by the mathematical geneticist Sewall Wright, include estimates of the number of genes contributing to a given quantitative phenotype. Such studies have not yet been made in psychogenetics.

tion of strain and breed differences in activity level (see Fig. 5-5), intelligence (see Fig. 5-6), temperament, and sensory phenomena (Fuller and Thompson, 1960). The extensiveness of these and related findings has led the authors of the most comprehensive survey of research on behavior

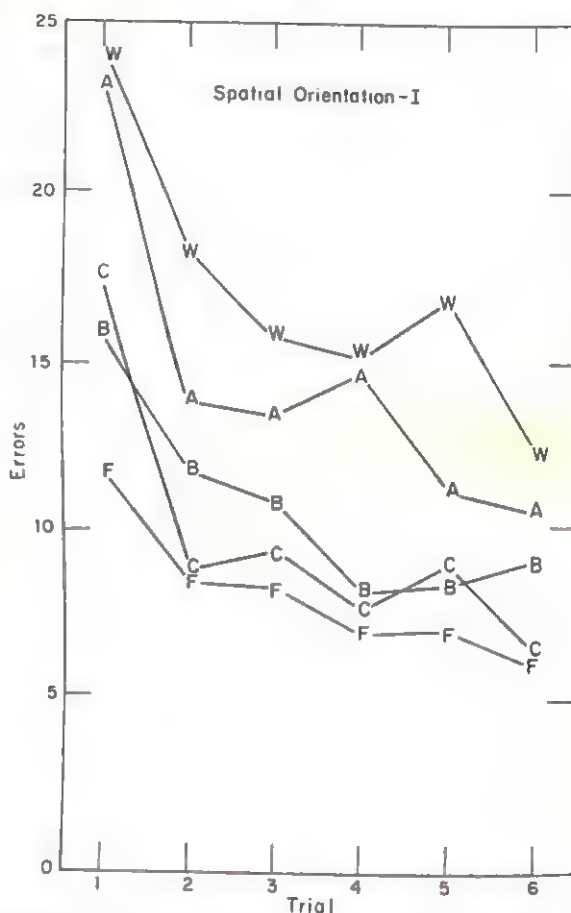


Fig. 5-6 Comparison of five breeds of dogs on a test of spatial orientation. A, basenji; B, beagle; C, cocker spaniel; W, wire-haired terrier; F, basenji; X, cocker hybrid. (Fuller & Scott, 1954, as reproduced in Fuller & Thompson, 1960, p. 217.)

genetics to the following conclusion: "Every kind of behavior comes within its scope, and the demonstration that a particular kind of behavior must be learned does not imply that it is uninfluenced by genetic variability." (Waters, Rethling-shafer & Caldwell, 1960, p. 326).

The writer has been pursuing research relevant to this last point, involving inbred mouse strains and the conditioned response. It was felt that the conditioned response, the simplest form of associative learning, represented a reasonable compromise

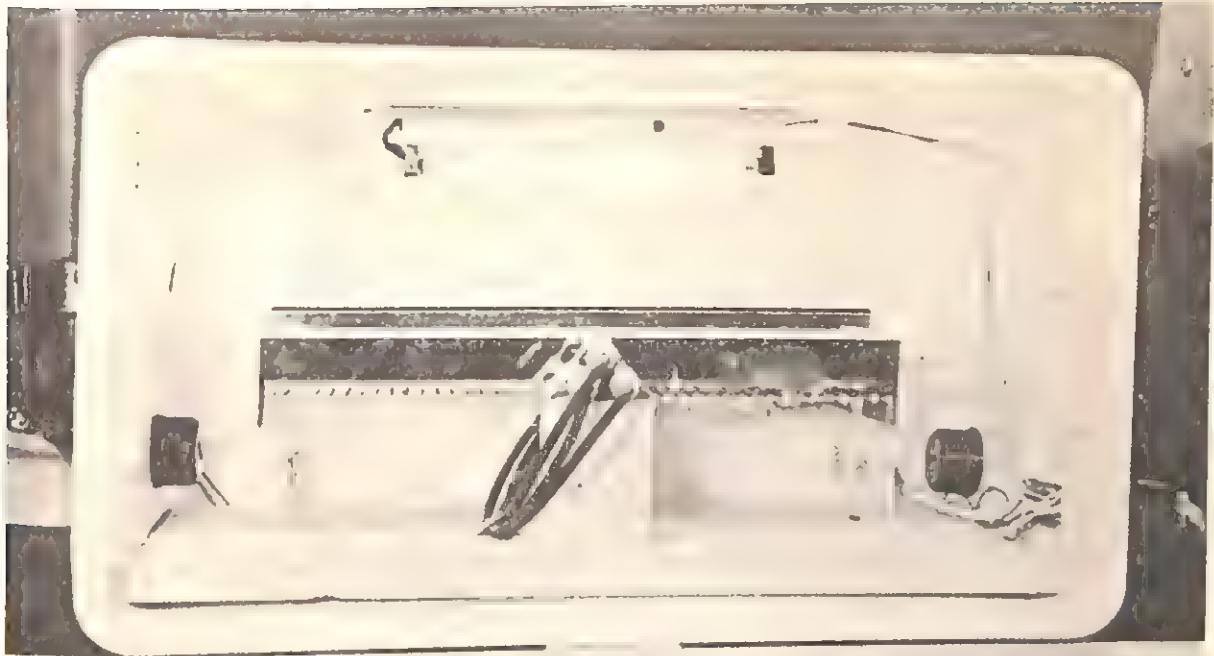


Fig. 5-7 The mouse shuttle box unit, showing a mouse on the right side of the grid, photo-electric cells at the center for automatically switching the power from one side to the other and for accumulating the responses of the S, buzzers mounted on the left and right walls, an air-conditioning motor and air porthole on the left, an overhead light to make the one-way mirror arrangement effective, all mounted within a semi-soundproof picnic ice box. The front unit (presently removed) is hinged from the outside and is faced with a one-way mirror so that the experimenter can look in without the mouse seeing out.

on the issue of working with a phenomenon of some behavioral significance on the one hand, and a phenomenon of relatively small variability on the other hand. Tropisms and seizures, for example, will provide the investigator with relatively fixed behavior, a very desirable characteristic if one plans on subsequent genetic analysis, but of dubious psychological significance. Maze learning or problem solving, on the other hand, is clearly of greater psychological significance than a tropism, but the variability of such behavior is more than the geneticist can contend with. The research in question was concerned with identifying strain differences in the avoidance conditioning of mice. A total of ninety-two mice representing samples of nine to twelve animals from each of nine Jackson Laboratory strains, were trained in an avoidance-conditioning shuttle box (see Fig. 5-7). The unconditioned stimulus consisted of a medium intensity electric shock, which was preceded by the sound of a buzzer (the CS). The animal could avoid the shock by simply running to the other

side of the grid. Various apparatus allow the investigator to control for such experimental parameters as shock level, the CS-US interval, and intertrial interval. Under a specified set of conditions, including a criterion of five successive successful CR's, the author found significant differences in the rates of conditioning and extinction as follows:

TABLE 5-2

Mean number of trials to the conditioning and extinction criteria (From Royce & Covington, 1960, p. 198)

Strain	N	CR		Extinction	
		M	σ	M	σ
SWR	9	51.22	84.21	25.88	15.35
C3H	9	73.11	37.73	25.55	22.71
DBA	12	124.75	57.65	15.50	7.96
BALB/c	11	136.63	78.09	19.81	8.04
C58	10	209.00	165.67	9.20	3.19

TABLE 5-3

Interstrain "t" values for conditioning and extinction trials (From Royce & Covington, 1960, p. 198)

Strains	SWR	C3H	DBA	BALB/c	C ₅₈
SWR		.03	1.75	1.01	3.02**
C3H	.67		1.20	.68	2.02
DBA	2.14*	2.36*		1.23	2.40*
BALB/c	2.21*	2.26*	.39		3.86**
C ₅₈	2.52*	2.39*	1.46	1.20	

Note:—The lower half refers to CR; the upper half refers to extinction.

* $p < .05$.

** $p < .01$.

The differences in rate of conditioning are more striking than the differences in rate of extinction, especially in the contrast between strains C₅₈ (mean number of trials = 209) and SWR (mean number of trials = 51.22). Overall, the findings indicate that strains C₃H and SWR condition most rapidly, but that they do not differ significantly from each other. The relatively high variabilities point up the difficulties of conducting genetic analyses under such conditions, as this magnitude of variability tends to mask mean differences. Research presently in progress (Royce, 1966b) indicates that changes in the several parameters mentioned above (e.g. CS-US interval, shock intensity, intertrial interval) decrease variabilities considerably while maintaining mean differences between strains.

INDIVIDUAL DIFFERENCES

Multiple factor analysis is the best available theoretical model to account for individuality (Royce, 1966c). It says, in its simplest sense, that the observed variability of a given phenomenon is dependent upon the permutations and combinations of a finite number of identifiable variables known as factors. If we confine ourselves to common factors, which are the ones which interest us most, and if we make certain other simplifying assumptions,⁹ we can express the basic equation of factor analysis as follows:

$$Z_j = a_{11}F_1 + a_{12}F_2 + a_{13}F_3 + \dots + a_{1m}F_m \quad (2)$$

This equation says that the score on any measurement j , expressed in standard score form (i.e.

where $z = \frac{x}{\sigma}$), is equal to the factor loading (a_{1j})

⁹ Such as dealing only with orthogonal or non-correlated factors. For an introduction to factor analysis see Fruchter (1954).

of the measurement j on factor one (F_1), plus the factor loading of the variable on factor two ($a_{12}F_2$), plus the loading of the variable on factor three, etc. For our purposes, the key to the matter is that the total variance of any measurement (j) is attributable to a specifiable number of factors (m). Furthermore, the total number of factors is a relatively small number, particularly in contrast to the number of observations it will account for. If we relate equations (1) (see p. 74) and (2) to each other, we can now focus our attention on that portion of the total behavioral variance which is attributable to genetic factors, as follows:

$$\begin{aligned} \sigma_T^2 &= \sigma_H^2 \\ &= a_{11}F_1 + a_{12}F_2 + a_{13}F_3 + \dots + a_{1m}F_m \quad (3) \end{aligned}$$

Thus, while we recognize the existence of environmental factors as determinants of variability, our present concern is with those sources of variation which are genetic in origin.

In our exposition thus far we have made a point of the fact that very few, if any, behavioral phenotypes are accountable in terms of the single dominant gene hypothesis. It has been pointed out that even relatively simple behavior such as convulsing, or the conditioned response, requires a polygenic rather than a Mendelian genotypic model. It seems clear, therefore, that complex behavior, such as temperament and intelligence, will require a multi-genetic model. The writer has proposed a logical linkage between the multiple-factor theories of genetics and psychology as the best available theoretical framework for future psychogenetic analyses. This model is depicted in Fig. 5-8. I have chosen general intelligence as an example of how any complex behavior may be broken down and eventually linked to its underlying genotype. Note that in both the behavioral and genetic domains many elemental factors account for a complex. On the psychological side many factors or behavioral phenotypes account for the complex we call general intelligence. On the genetic side various combinations of many genes account for a particular behavioral phenotype such as S or M. Thus, a person may inherit all of the dominant forms of the gene pairs of the Space factor (i.e. AA, BB, CC, DD). Since this means that the individual has the maximum number (four chosen arbitrarily) of dominant genes for this particular genotype, we would expect him to

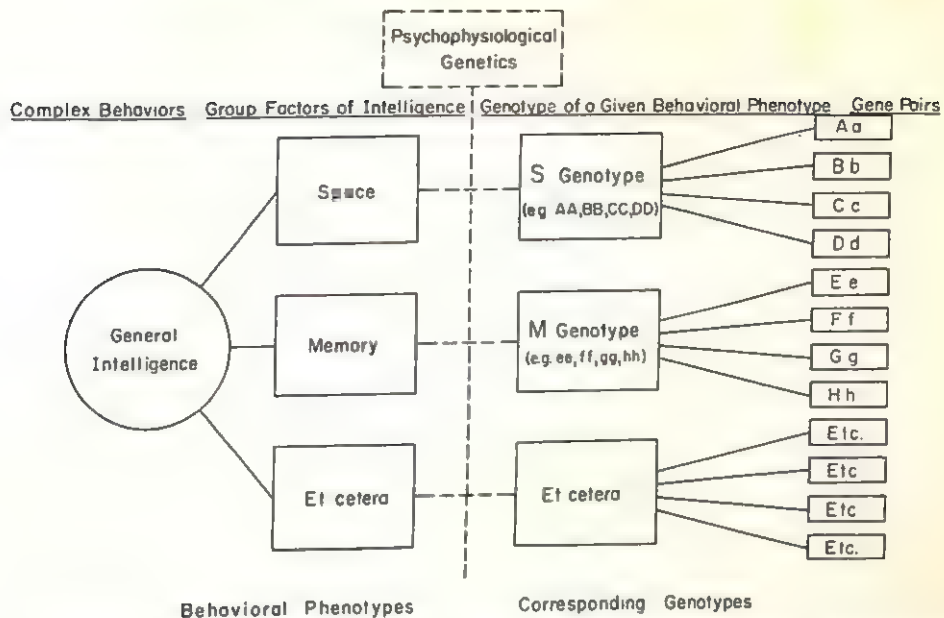


Fig. 5-8 Showing the most probable linkage between the multiple factor theory of psychology and the multiple factor theory of genetics. The capital letter signifies the presence of the trait or phenotype; the small letter means the absence of the characteristic. (After Royce, 1957, p. 370.)

perform at the highest level in tasks involving the perception of spatial relationships. If another person inherited genes *e*, *f*, *g*, and *h* from the available gene pairs of the M factor we would expect a minimal performance on pure memory tasks.

These high and low peaks of mental ability profiles are, of course, well-established in the psychological literature. However, only a beginning has been made in providing genetic correlate evidence for such factorially determined components. The evidence on the human level comes from three studies (Thurstone, Thurstone, & Strandskov, 1953; Blewett, 1954; Vandenberg, 1956) involving monozygotic and dizygotic twins and the Primary Mental Abilities. The findings reported by the Thurstones and Strandskov are typical, and are briefly summarized in the next table. The interpretation is that the first four factors, *space*, *verbal*, *fluency*, and *memory* manifest a strong hereditary determination. The implication is that the performance of single-egg twins is more alike on these four factors, which reveal significant chi square values, than is the case for two-egg or fraternal twins; hence, the importance of the genotype. The trouble is that the available data on human populations is very minimal, and further, it is contradictory. The only factor on which there is agreement by all three investigators is verbal comprehension!

It is the writer's opinion that this question is more likely to receive a convincing answer from animal research. Significant advances have been made during the past decade in non-factorial behavior genetics (Fuller & Thompson, 1960), particularly with the availability of highly inbred

TABLE 5-4

Chi squares and statistical probabilities for the inheritance of primary factors of primary mental ability. (From Thurstone, Thurstone, & Strandskov, 1955, as reproduced in Fuller & Thompson, 1960, p. 203)

P.M.A. Factor	Chi Square	P
Space	14.38	.01
Verbal	12.93	.01
Fluency	5.25	.01
Memory	4.09	.05
Number	2.12	.10
Reasoning	0.40	.30

strains of mice. Furthermore, a convincing factorial beginning was made some years ago by Wherry (1941) in his analysis of Tryon's bright and dull strains of rats. He found the same three factors he had previously isolated—forward going, food pointing, and goal gradient. But he reported the additional finding that dull animals make

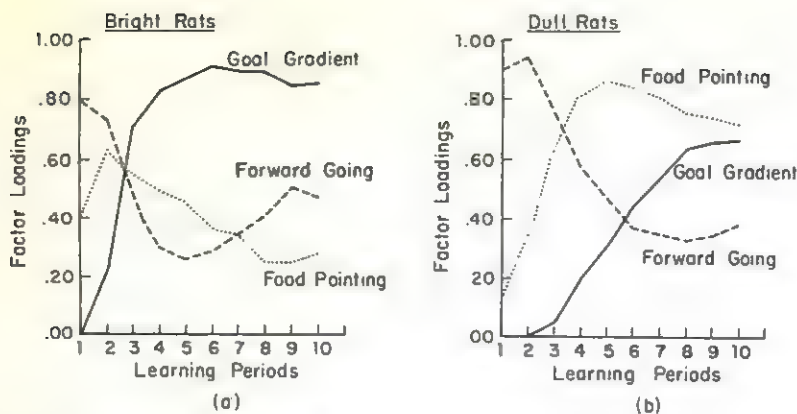


Fig. 5-9 Profiles of factor weights obtained by Wherry from Tryon's maze data. (From Royce, 1950, pp. 244-245.)

greater use of the food-pointing factor and less use of the forward-going factor, whereas the bright animals clearly outclass the dull ones in the extent to which the goal gradient (or insight) factor is involved in maze learning. These striking results are brought out clearly in Fig. 5-9. These findings are convincing, for they involve over 500 animals in each strain, and the data were based on Tryon's twenty-year selective breeding program. Furthermore, there is very strong likelihood of a tie-up with Krech's non-factorial findings to the effect that bright rats make greater use of spatial (i.e. goal gradient factor) "hypotheses," while the dull rats are more likely to involve visual (i.e. forward-going factor) "hypotheses." There is insufficient space to relate these data to the recent biochemical correlate studies (e.g. Krech, 1954; King, 1960, 1961; Hughes and Zubek, 1956, 1957a, 1957b; Marx, 1948, 1949; etc.) which suggest that variations in genetically controlled biochemical processes¹⁰ constitute one of the biological bases for the observed differences in the factorially determined components of behavior.¹¹

¹⁰ This point has even been made at the protoplasmic level, as genetic differences have been demonstrated in three species of amoeba. Both structural and behavioral differences were observed, including characteristic species differences in the number of pseudopods which occurred during locomotion. The implication of this finding is that there are non-differentiated biochemical differences within the protoplasmic makeup of the several strains of amoeba which determine its psychobiological functioning.

¹¹ For a more complete coverage of the relevance of factor analysis to the domain of comparative-physiological psychology see several publications of the writer (e.g., especially Royce, 1957, and 1966a).

COMPARATIVE PSYCHOLOGY

The major concern of the comparatively-oriented student of behavior is to determine the similarities and differences in the behavior patterns among the fourteen phyla and the million species of animals (see Fig. 5-10).¹²

The comparative anatomy and comparative physiology fields have already established such now obvious findings that, in general, as we ascend the phyletic series, there is an increase in the biological complexity of organisms. We can, therefore, anticipate a parallel increase in the behavior repertoire of organisms as we move from amoeba to man. There is already sufficient evidence to establish this point. It does not follow, however, that man will always be at the peak of the phyletic series when we analyze a specific biological or psychological characteristic or trait. For example, it is obvious that the morphological characteristic for locomotion via flying reached its evolutionary peak in birds, that the dog's level of pitch discrimination is higher than man's, that ultrasonic navigation and communication is best in bats and sea mammals such as porpoises, whales, and seals, and that the highest levels of visual acuity occur in hawks and birds of prey. It seems clear that such phylogenetic peaks are related to the evolutionary concept of adaptation. For example, since movement by flight is more crucial to birds than man, and since the medium of the sea requires some kind of oxygen intake by way of gills

¹² Roughly broken down as follows: 128,000 species of invertebrates other than insects; 850,000 species of insects; 20,000 species of fish; 6,000 species of amphibians and reptiles; 8,600 species of birds; 3,200 species of mammals.

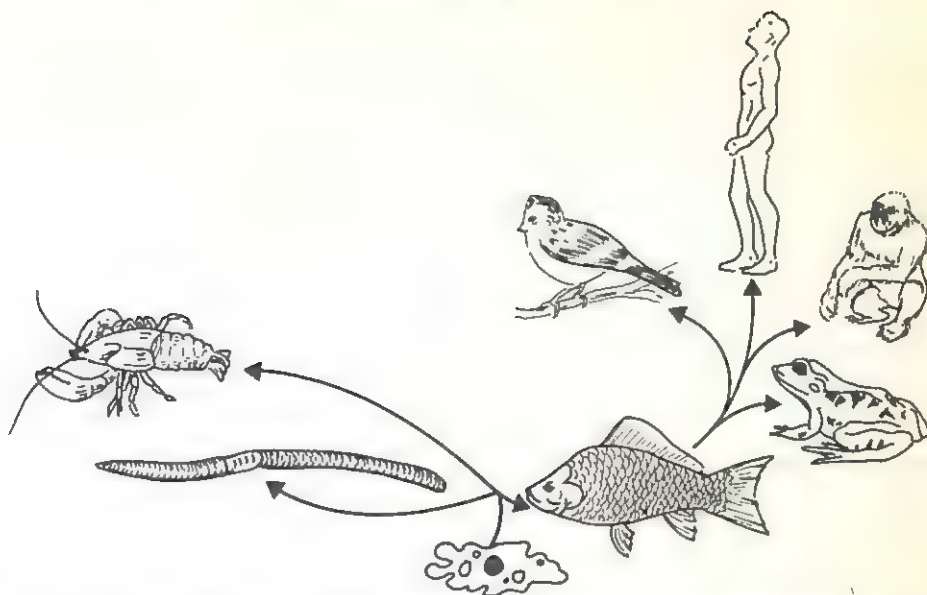


Fig. 5-10 The modern conception of the relation of phyla in the evolutionary tree. Many of the lower varieties are of course missing from this figure, which is designed principally to represent the vertebrates, known technically as a subphylum of the phylum Chordata. Fishes, amphibia, birds, and mammals are classes within the subphylum. Within the mammalian class the primates are referred to as an order. We belong to the suborder Anthropoid, family Hominidae, genus *Homo*, and species *sapiens*. (From Hunter and Hunter, *College Zoology*, Saunders, 1949, p. 690.)

in fish, it should come as no surprise that sub-human animal forms may surpass man in any given psychobiological capacity. The phylogenetic analysis of behavior is concerned with tracing this development, indicating evolutionary changes, evolutionary peaks, and the correspondence between biological and psychological change.

THE PROBLEM OF A BEHAVIORAL TAXONOMY

A crucial problem in conducting such analyses is that of behavioral units. The zoological taxonomy provides a workable framework for dealing with the variety of biological forms, but we have no adequate taxonomy for dealing with behavioral variability. There is no real difficulty with relatively simple behavior, such as reflexes and conditioned responses, as an appropriate classification of such behavior will evolve as empirical knowledge increases. For example, the present division of the conditioned response into two large categories of classical or stimulus-elicited conditioning and operant or non-stimulus-elicited conditioning, is a case in point. Subdivisions within each of these, such as escape and avoidance conditioning, provide additional workable units of behavioral analysis. The problem arises when we

are dealing with more complex behavior as encountered in the subjects of personality, psychopathology, and intelligence. The solution to this problem requires some method of dimensional or component analysis so that comparisons between species will be based on the same behavioral unit. Additional problems peculiar to interspecies comparisons, such as equating motivational levels and stimulus inputs or difficulty level of problem solving tasks, merely highlight the more fundamental one of identifying the principal axes of behavior. The mere listing of apparently relevant behaviors on the grounds of logic carries with it the inherent multiplicity of such schemes. Psychologists in the 1920's attempted to resolve the instinct problem in this way, and they emerged with as many lists of basic instincts as the number of classifiers. Thus, Nissen's (1958) six-category (sensory capacities, locomotion, manipulation, perception, sensorimotor connections, reasoning) scheme is subject to the same criticisms as the instinct classifiers.

Much more promising are approaches such as information theory and factor analysis, for they involve concepts which transcend personal predilections. Let us focus on the problem of phyletic

analysis of sensory inputs as a case in point. We will define sensory inputs as any mode of receptor pickup and transmission of physical energy. Such physical energy might be in the form of light, sound, heat, chemicals, pressure, and so on. The receptors in question might vary from those involved in the general approach or withdrawal reaction of a glob of protoplasm in the form of an amoeba to the varieties of optical system which involve specialized substructures such as rods and cones for dealing with brightness discrimination and color discrimination. Information theory involves the translation of all sensory inputs, regardless of degree of protoplasmic differentiation or sensory modality, into "bits" of information. The word bit, which is a contraction of the words binary digit, refers to a two choice or yes-no logarithmic (base 2) number system. The analogy of nerve conduction or the digital computer best clarifies what is involved here. Nerve conduction (see pp. 55-56) involves the all-or-none principle, which means that a threshold or supra-threshold stimulation of nerve tissue will result in activation of the neural impulse, whereas sub-threshold stimulation will not. The point is that there are only two possibilities—either the nerve is activated or it is not.¹⁸ Similarly, in the case of the digital computer, one of the two possible choices will be coded as 1, and the other choice will be coded as 0. Multi-channeled yes-no systems, such as the nervous system and electronic computers, can allow for tremendous flexibility of communication. An information theory analysis of sensory inputs would involve the designation of all supra-threshold stimuli with the digit one, and the coding of all sub-threshold stimuli with the digit zero. Merely adding up all the one ciphers, regardless of sensory modality, for a standardized range of light, sound, pressure, and other physical values provides a valid index of psychophysical information which would allow for interspecies comparisons.

Factor analysis provides another approach to interspecies comparisons to the extent it is capable

¹⁸ Recent research, such as that summarized by Bullock (1959) and Bishop (1956), suggests that the classical all-or-none theory of nerve conduction is necessary but not sufficient. For example, they report all-or-none conduction for the axone and a gradient theory for the dendrites. The gradient theory does not deny the all-or-none principle, but it does imply a modification of the classical theory.

of identifying behavioral dimensions which transcend subjects and measurements sampled. Factors are theoretical constructs or dimensions which account for a web of covariations which manifest themselves in a correlation matrix. When factors are repeatedly identified, especially under a variety of sampling conditions, we refer to such factors as invariant. Since it is obvious that no construct, factorial or otherwise, remains invariant under all circumstances, it is a matter of empirical study to determine the limits of invariance for each factor. For example, the writer has compiled evidence of interspecies factorial invariance for two emotionality factors, autonomic balance, and motor discharge, summarized in Table 5-5.

TABLE 5-5

Two apparently invariant factors of emotionality (Adapted from Royce, 1966a)

Investigator and Year of Study	Factor I (Autonomic Balance)	Factor II (Motor Discharge)	Species
Willingham (1956)	Elimination	Freezing	mouse
Billingslea (1941)	Timidity	Freezing	rat
Royce (1955)	Timidity I (physiological)	Timidity II (Motor Discharge)	dog
Wenger (1948)	Autonomic Balance	Muscle Tension	human (children)
Freeman (1948)	Energy Arousal	Discharge control	human (adults)

The major point is that these two factors not only transcend investigators, but more importantly, a wide variety of species samples which range from mouse to man. An important implication in this approach is that it might be possible to identify factors common to several species in spite of differences in the specific measurements used to identify the underlying factors. This is an important point, as morphological and other biological differences between species make it mandatory that the psychologist present his test situations in ways which are appropriate to the species in question. For example, a string-pulling task for assessing immediate memory would be appropriate for the monkey or the cat, but would not be in the normal behavior repertoire of the dog or the ant. While a dog might eventually be able to manipulate a string, such a task for the dog would shift from a cognitive one to one of motor dexterity. It would be more appropriate to set up a hole-digging task for the dog, and a simple

maze task for the ant. Subsequent factorial analyses would then reveal whether the surface differences in the tasks are, in fact, tapping the same underlying cognitive component of immediate memory.

It has been pointed out that at present there is no systematic taxonomy of behavior which can serve as an adequate basis for subsequent phylogenetic comparison. In spite of this inadequacy, rough interspecies comparisons have been made, three examples of which will now be briefly presented. In keeping with our selective sampling approach, each of the three examples will be representative of a broad category of behavior. Our categories are based on the *S-O-R* (stimulus-organism-response) paradigm, which can be taken as a crude behavioral taxonomy basic to an eventual classificatory scheme. That is, the phylogenetic comparison of visual processes will be presented as an example of a behavioral phenotype, or a complex of behavioral phenotypes, at the *S* or sensory input end of the behavioral spectrum. Species comparisons of intelligence will represent *O* variables, or mediating and integrating mechanisms of behavior. And comparisons of species similarities and differences in locomotion will reflect the response (*R*) aspect of the *S-O-R* paradigm.

THE EVOLUTION OF LOCOMOTION

Proficiency in locomotion appears to be highly related to the degree of neural development which is achieved throughout the phyla. One might infer that man, with his highly developed nervous system, would stand high at the top of the list of locomotor dexterity. However, it will become apparent as we examine the various forms of locomotion that certain of the arthropods, the birds, and some of the lower mammals far exceed humans in locomotor ability. They orient themselves with a higher degree of adroitness and they travel faster.

Lower Invertebrates. Coordination of locomotion is severely limited in most elementary forms of life by a crude nervous system. The crudest form of locomotion is accomplished by the single-celled amoeba, which, when lightly touched in a given place, forms a fingerlike protuberance known as a pseudopod. Subsequently the entire animal may move in the direction of the newly formed pseudopod. Other protozoa have hairs, or

cilia, which move the animal about by rhythmically beating back and forth. Still other protozoa, the flagellates, are propelled by a long whip-like flagellum, the whipping stroke of which pulls the animal forward with the sensitive end in advance. Farther along the spectrum, the medusa exhibits a radical change in method of propulsion. The medusa is moved through the water by rhythmic opening and closing movements of its bell, or umbrella. Each contraction forces water from the bell cavity, and spurts the animal forward. Such a principle is utilized by man today with the development of the water-jet-propelled boat.

Finally, in the planaria, we see the first instance of locomotion by gliding, a method of locomotion which is common to many worms and reptiles. The planaria attaches tissue on its ventral (front) side to the substratum, then pulls itself forward. The tissue is then reattached, and the whole process repeated.

In absolute terms, locomotion in the lower invertebrates is extremely slow, but in terms of their body dimensions, the invertebrates are very fast. One ciliate, for instance, may travel seventy times its own length in one second, while a walking man scarcely covers his own length in the same amount of time.

Higher Invertebrates. The insects display the widest diversity of forms of locomotion in the higher invertebrates. Insects swim, crawl, walk, run, and fly. The most unusual method of transportation is the ballooning phenomenon which young spiders display. Spiderlings will climb as high as possible in a tree or some other high object. Facing the breeze, the spiderlings will secrete a drop of silk, which is drawn out into threads by the wind. When the wind is pulling the thread with sufficient force, the animal simply lets go and floats away. Darwin recorded the arrival of young spiders on his ship when it was sixty miles from the shore.

The insects are probably the only animals with true wings; unlike other animals, the insects have wings which are not merely adaptations of other organs for flying. Birds and bats, for example, developed their wings around existing forelimb structures; five "fingers" can still be recognized in the skeletal structure of the wings.

Lower Vertebrates. The most uniformly-shaped group of animals are the varieties of fish. This

low variability in morphology is due primarily to the fact that these animals live in a fluid medium and move about by vigorous displacement of the same medium by movements of appendages. Other animals in this same category include certain protozoa, birds, and aquatic mammals such as seals and whales. Animals which effect locomotion by contact with fixed objects are found in far greater variety of shapes. Fish typically achieve locomotion with rhythmic lateral movements of the tail fin, aided somewhat by movements of other fins as well. In some fish, such as the flying fish, the lesser fins have become tremendously developed and enlarged, enabling the fish to leap from the water at great speed and glide with the wind for distances up to 200 yards. Certain other fish have developed a capability for crawling for short distances on land and even up the trunks of trees.

In the amphibians we find, for the first time, animals with two pairs of limbs. In those amphibians which live largely on land the hind limbs are large and powerful; this enables them to perform enormous leaps. Frogs, for instance, are capable of jumping eight feet or more.

Most reptiles, except snakes, are capable of walking or running on four legs. However, in some lizards we see a development which foreshadows locomotion achieved by higher forms of life. A few species of lizards run on the hind feet with the fore feet clear of the ground. This is the first example of bipedal locomotion.

Perhaps the most spectacular behavior capacity possessed by birds is that of flight. The structural adaptations of birds have been determined chiefly by the requirements of living in the air. For example, in many birds, the wing muscles comprise from one-third to two-thirds of the total weight of the animal. Its ratio of power to weight is higher than that of any other vertebrate.

There are three types of bird flight: gliding, flapping, and soaring. All birds are capable of the simplest of the three, gliding, which is the briefest form of flight. Flapping requires considerably more energy as speed is necessary before flapping becomes efficient. Only the very strongest fliers, such as humming birds, are capable of hovering. The soaring birds provide an intriguing model of aeronautical engineering. These birds have such perfect proportions and lifting surfaces

that they are almost structurally ideal for the aerial medium.

Higher Vertebrates. Most of the sub-primate mammals are capable of quadrupedal locomotion on land. This is certainly the most common mode of travel. Usually the pectoral limb on one side moves almost simultaneously with the pelvic limb of the opposite side. Great speed is possible with this type of arrangement.

Bats are unique among mammals because of their capacity for sustained, rapid flight, and for their exceptional maneuverability in flight. Their maneuverability is enhanced by a radar-like navigation system based on ultrasonic beeps emitted by the animal.

Locomotion in monkeys and apes is usually quadrupedal, but the development of an opposable thumb greatly increases manipulatory ability of the forelimbs, resulting in greater emphasis placed on the hind legs as locomotor agents.

The most remarkable thing about human locomotion is the posture assumed. All other primates travel on all fours, whereas man travels exclusively on his hind legs. The effects of this change, one of the main contributors to the development of human intelligence, may be summarized as follows:

1. The upright position increases the range of vision during locomotion.
2. Upright locomotion releases the front limbs for manipulation.
3. Use of the forelimbs in manipulation releases the mouth from manipulatory activities, increasing its flexibility, primarily for communication.

Man has partially sacrificed an ability in locomotion for a greater ability for manipulation and communication, and consequently his activities and behavior have become less and less oriented to locomotion and flight, and centered more and more on toolmaking and symbolic processes.

THE EVOLUTION OF VISION

Much attention has been focused on reactions of organisms to the various physical dimensions of light, including intensity, wavelength, form and pattern, rate of change of intensity, and size. Among these stimulus variables, discrimination of forms and patterns is well worth considering

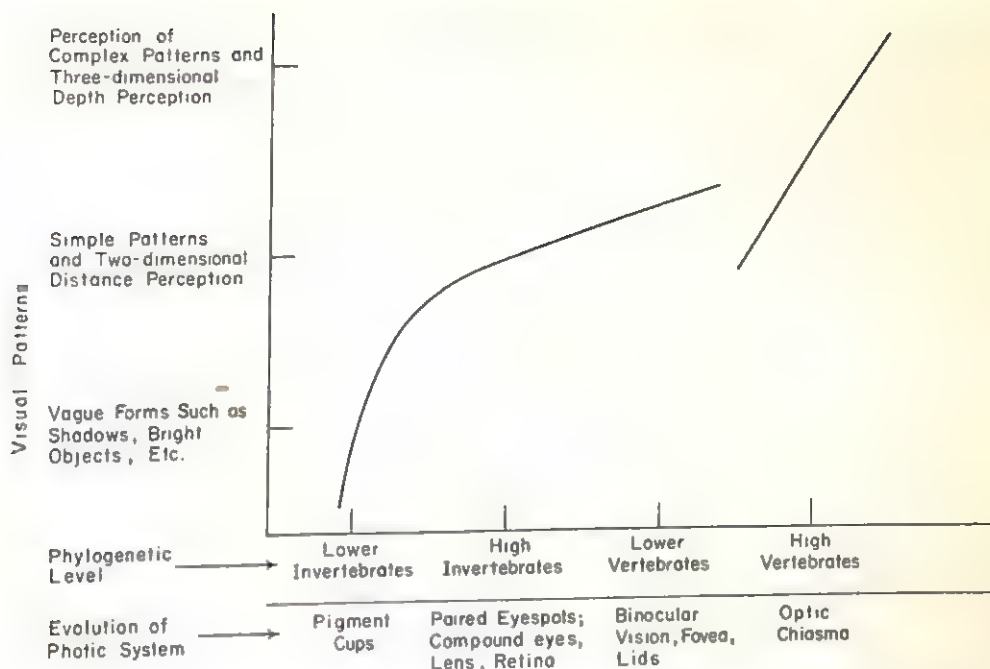


Fig. 5-11 The relation of form discrimination to visual development across phyla.

because of its importance in learning and perceptual processes from insects to man.

Ability to perceive differences in patterns and forms throughout the phyla is indicated schematically¹⁴ in Fig. 5-11 by a curve which rises as we ascend the phylogenetic scale. Form discrimination is almost nonexistent in protozoa, but as the curve continues we see that it rises rapidly in the invertebrates, particularly in the insects, and then continues at a slower rate until it reaches the birds.

Between the birds and lower mammals there exists a wide gap in discriminative ability, with the birds displaying a significant superiority over the lower mammals. Such a gap is illustrated in Fig. 5-11. Most lower mammals are relatively poor in form discrimination, at least when compared with birds. After the gap is bridged however, ability to discriminate forms and patterns greatly increases in primates and man, and eventually

far exceeds the degree of ability achieved by birds in this sphere of perception. An overall increase in ability to discriminate forms and patterns is indicated as one ascends the phylogenetic scale, but this ability is closely linked with structural developments of the visual organs throughout the phyla. A brief summary of the phylogenetic changes in visual structures is also shown in Fig. 5-11.

Lower Invertebrates. The earliest structural differentiation for light reception is found in the protozoa, of which *Euglena* (a flagellate) is perhaps the best example. *Euglena* is only a single-celled animal, but it possesses a permanently sensitized area in its anterior end which is sensitive to light. The stigma, or eyespot, consists of a reddish oily pigment which is roughly cup-like in form. This type of photoreception is not sensitive to distinct images, but rather to general changes in intensity and, to some extent, the direction of light. Figure 5-11 indicates the very poor ability of these organisms to perceive patterns.

Sudden changes in illumination produce behavior which closely parallels the startle response in vertebrates. After being exposed to a rapid change in intensity of illumination, one species

¹⁴ Schematic because it represents the author's best guesses from the available experimental literature. The evidence is too sparse and our concepts too gross for a more precise presentation at the present time. A similar scheme is presented for intelligence in Fig. 5-13.

(*Bacterium photometricum*) reacts by darting backwards a distance of ten to twenty times its body length. Such violent reactions as these, which are greatly diminished in other phyla, have been termed shock reactions.

Higher Invertebrates. Eyes which can differentiate size and shape of objects can be classified into three groups: compound, fixed focus, and variable focus (see Fig. 5-12). Compound eyes

The cruder photoreceptors are used for general orientation to light, while their more specialized and advanced counterparts are effective for precise localization, especially in food-gathering and locomotion.

The insects, on the other hand, while possessing the greatest diversity of photoreceptors, are typically equipped with paired compound eyes containing from one to thirty thousand facets, and

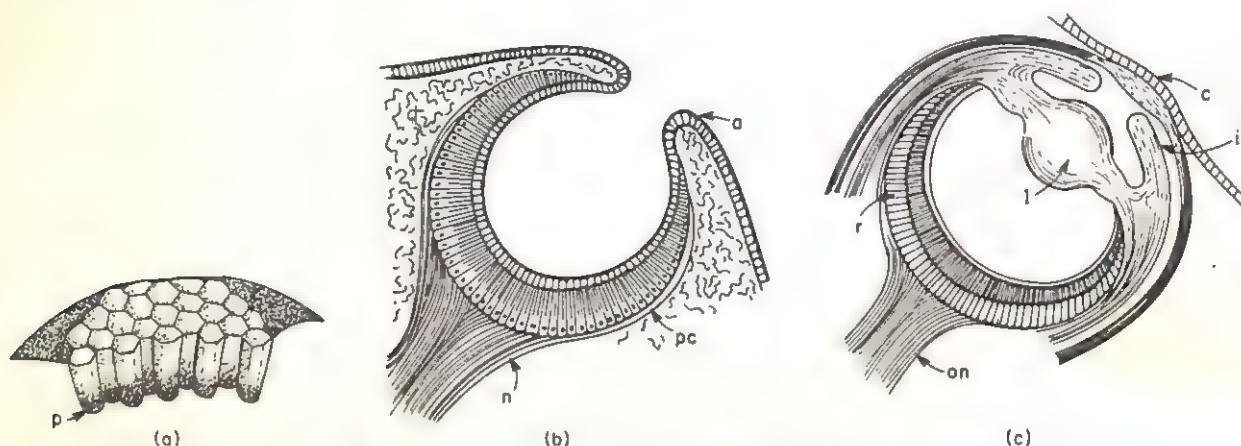


Fig. 5-12 Evolution of the eye. (A) compound eye of *Diadema setosum*; (B), fixed-focus eye of *Nautilus*. The cavity is filled with water. (C), eye of variable focus possessed by the cuttlefish. a, ordinary epithelial cells; p, pigment cups; pc, pigment cells; n, nerve fibers; on, optic nerve; c, cornea; i, iris; l, lens; r, retina. (Adapted from Munn, 1955, p. 90.)

make their earliest appearance in some species of worms. These eyes consist of many facet-like photosensitive units, and there is evidence that animals with compound eyes are able to discriminate structural details. There is evidence that some animals with compound eyes may also be able to discriminate in terms of wavelength. Von Frisch has found that the bee's spectrum, as compared with man's, appears to be shortened at the red end and lengthened at the ultraviolet end.

Some molluscs, such as the cuttlefish and octopus, have developed fixed-focus and variable-focus photoreceptors which outstrip their position on the phylogenetic spectrum below insects. These animals have a highly developed eye compared to the insects above them; it consists of a cornea, iris, retina, and a movable lens capable of some accommodation. However, they have not developed these organs at such a rate that they have discarded their old forms of photoreception. The octopus possesses both the elementary fixed-focus pigment cups and the variable-focus eyes.

many also have the more elementary pigment cups, or eyespots. Consequently, many insects, as well as the octopus and cuttlefish, are capable of detecting both changes in intensity and the position of objects.

Some insects are also capable of discriminating both simple and complex patterns. Wasps, for instance, are sensitive to a variety of spatial relationships involving size, brightness, and form. Bees also are quite capable of discriminating two- and three-dimensional objects, patterns, and figure-ground relationships. A steep climb from the lower invertebrates in discriminative ability is indicated in Fig. 5-11.

Lower Vertebrates. Many species of fish are equipped with a cornea, iris, and a lens which moves back and forth within narrow limits, providing some focusing. Experiments have demonstrated that sticklebacks, minnows, and dories discriminate between various figures differing in shape, such as triangles, squares, crosses, and diamonds. Little is known about detail vision in

amphibians and reptiles, but their eyes are sufficiently elaborate to provide such vision.

Among the lower vertebrates birds have by far the best vision, and in many cases it exceeds the visual development of lower mammals. Birds possess eyes which are capable of rapid accommodation and focusing, which is accomplished by curving both the cornea and the lens. Some species, such as owls, have even developed binocular vision. Birds typically have very good discrimination of visual detail, and in high-flying birds of prey visual acuity is outstanding. Most of the lower vertebrates are excellent perceivers of motion, responding to the slightest quiver of the object under scrutiny.

Higher Vertebrates. Compared to birds the lower mammals come in a poor second (see Fig. 5-11). Having no fovea (a small area of great sensitivity near the center of the retina), the lower mammals have only a vaguely defined sensitive area which cannot approach the birds' eyes for perceiving details. The eyes do converge to give binocular vision in the dog and in several other animals, but otherwise binocular vision is extremely limited.

The primates, however, do have a fovea, and so does man. Contrary to popular belief, the most important development of vision in the higher mammals is not in visual acuity, but rather in the ability of the organism to perceive the dimensionality of objects and to accurately judge depth and distance. In all animals ranging from subprimate mammals to insects the image received on the left retina is transmitted to the right side of the visual cortex in the brain, while the image received on the right retina is relayed to the left visual cortex. The eyes are at the side of the head, and each eye transmits a visual field entirely independently of the other. As we ascend the scale of evolutionary development, we find that the eyes move closer together towards the front of the head, achieving a closer coordination between the eyes and the images which they receive. Finally, at the highest level of development, in the primates, the eyes are not only close together at the front of the head, but the images on each retina are divided into right and left halves. Stimulations on the left half of each retina are joined at the optic chiasma en route to the right side of the brain, and similarly the stimulations on the right side of each retina are joined at the chiasma on their way to the left side of the brain.

Such an arrangement enhances stereoscopic vision, the ability to perceive tridimensionally. In animals with two-dimensional vision, distance can still be perceived, but only by using different perceptual cues than are used with stereoscopic vision. Animals which perceive objects bidimensionally (similar to what humans see when looking at a photograph or with one eye closed) use cues such as perspective and gradient of texture (i.e., closer surfaces appearing rougher). Animals equipped with stereoscopic vision, on the other hand, can perceive depth not only from the cues mentioned above, but also by superimposing on top of each other two images viewed from different angles, thereby producing tridimensional depth. This process of superposition is made possible by the optic chiasma and does not occur in animals with bidimensional visual systems, even when the eyes are close together at the front of the head. Crossing over of the visual pathways to opposite sides of the cortex is not necessary for the perception of two-dimensional distance cues; however, crossing over and superposition is required for seeing in three-dimensional depth.

THE EVOLUTION OF INTELLIGENCE

In terms of the *S-O-R* paradigm, intelligence is an *O* construct. Intellectual processes are at least more central than either *S* inputs or *R* outputs. Although there are recognizable contributions from both sensory and motor processes, it is generally conceded that the physiological correlates of intelligent behavior are primarily related to the evolution of the central nervous system. A schematic summary of the probable relationship between the phylogenetic development of nervous structures and intelligent behavior is given in Fig. 5-13. In Fig. 5-13 we reflect different levels of intelligence from the relatively fixed or stereotyped pattern of behavior, which is typical of the invertebrate species, to the highly modifiable behavior of subhuman and human primates. The term fixed-modifiable is meant to convey a mixture of stereotyped and plastic behavior, with fixed behavior dominant. Imprinting would be a good example of such behavior, characteristic of the higher invertebrates and the lower vertebrates. The term modifiable-fixed reflects the dominance of modifiability, but with considerable behavioral rigidity remaining in the animal's behavior repertoire. The lower mammals best reflect such be-

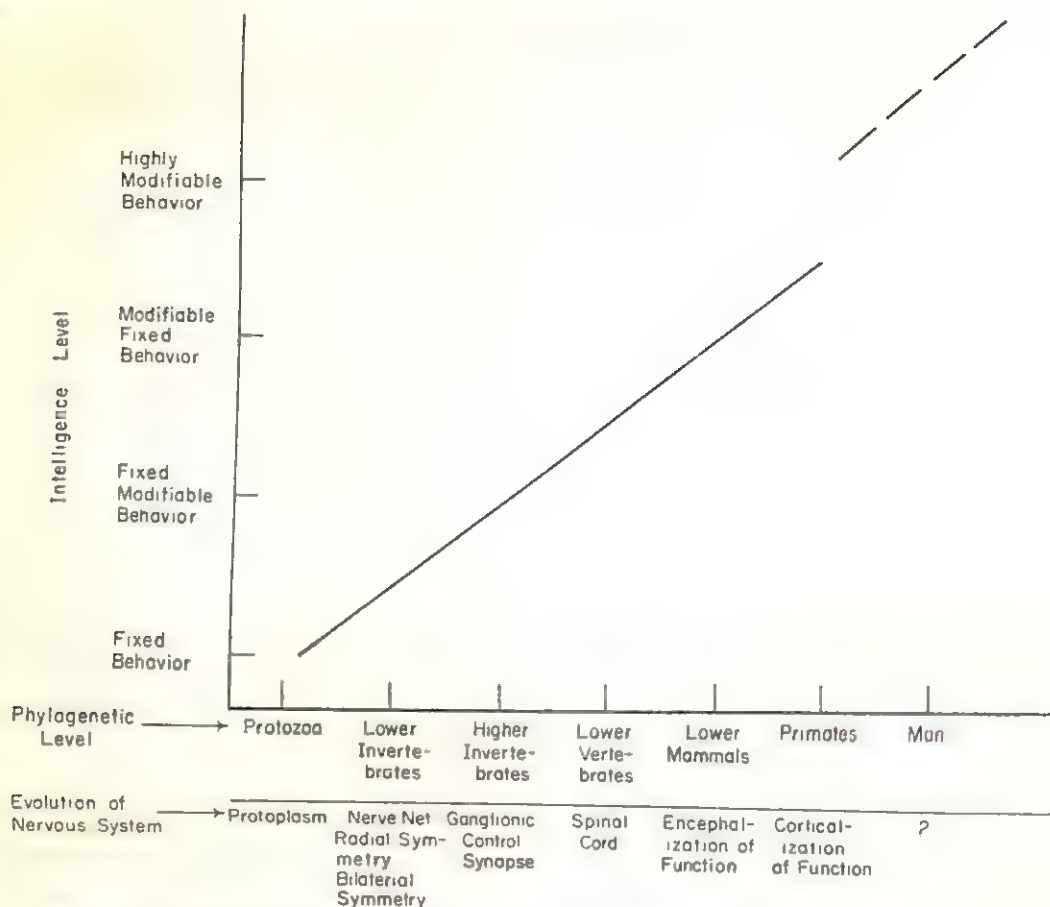


Fig. 5-13 A schematic estimate of the evolution of the nervous system and intelligence.

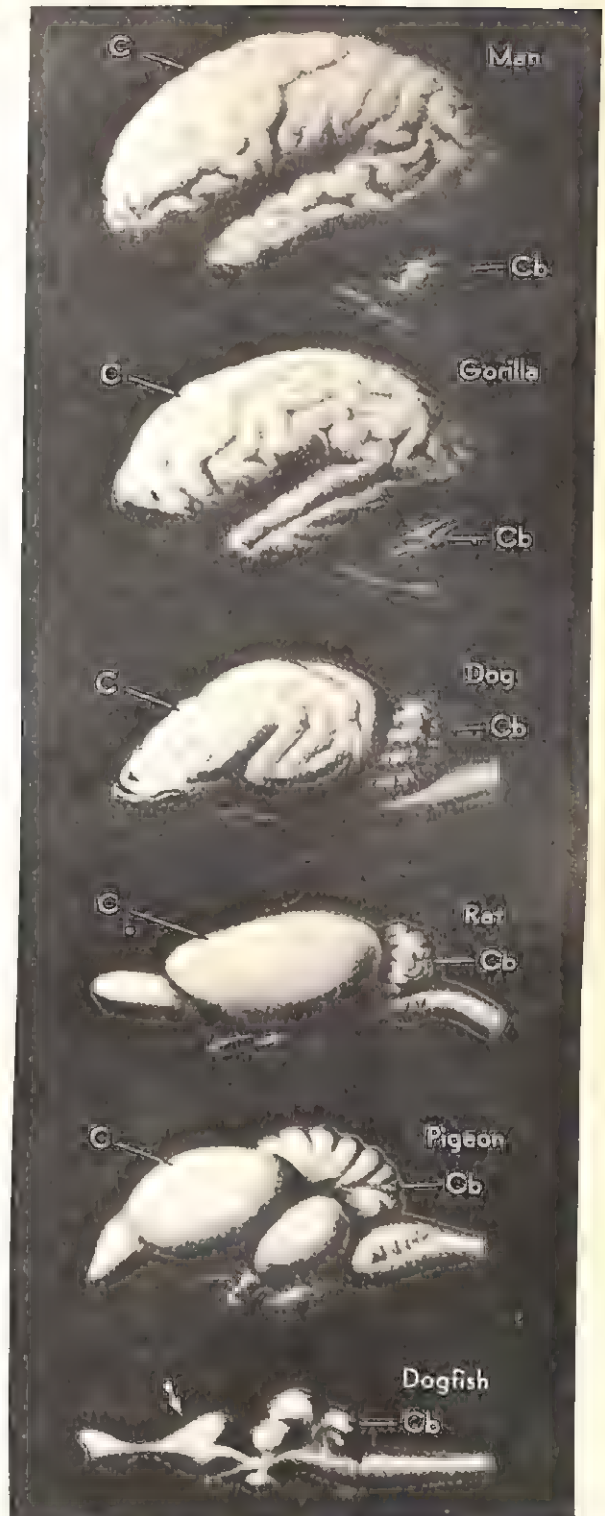
havior. The overall picture portrayed in this diagram is one of continuity from amoeba to primate, reflecting a steady climb in intelligence parallel to certain key changes in neural structure. These key changes, grossly summarized by phyla in the second row of the abscissa, range from the availability of conductivity or irritability in the protozoa, to the highly differentiated cortical structure of man and primate. Thus, the fact that a single-celled glob of protoplasm such as the amoeba is capable of reacting, even if this is only via relatively undifferentiated movement toward or away from a source of light, constitutes a degree of intellect. Such low-level intelligence can best be thought of as adaptive wisdom built into the species, rather than the more individual intelligence characteristic of man. The later emergence of a nerve net, combined with some kind of bodily symmetry, results in a more differentiated response pattern than is possible with raw protoplasm. However, it is not until the evolution of

ganglionic control centers and the synapse that the first true signs of modifiability become part of the behavior repertoire. The greater channelization of nerve impulses which accompanies these developments allows for the storage and retrieval of information—the emergence of true memories and habits. Thus, the insects, at the apex of invertebrate adjustment, although still dominated by relatively fixed behavior patterns, possess a high level of sensory and motor equipment, exhibit the ability to traverse complex maze patterns, and reflect a high degree of social organization. However, it is not until we reach the last phylum (XIV, Chordata) that a true central nervous system emerges. In the lower vertebrates, for example, the tubular spinal cord first appears, allowing for a much greater degree of central integration of the increasing differentiation of nervous structures than the earlier ganglia. The combination of ganglionic control and bilateral symmetry eventually led to the development of

a head-dominated physiological gradient known as encephalization of function. The gradual localization of psychological functions in the head end of the organism is the dominant theme of the evolutionary process. There is little doubt that this has occurred at the neural level, and there is little doubt that intelligent behavior is primarily housed in the cerebral hemispheres of mammals. Because of the great importance of the cerebrum, and particularly of the cortex, it is desirable that we take a closer look at the evolution of the mammalian brain. The major point in Fig. 5-14 is the obvious increase in brain size, particularly of cortical tissue, as we ascend phylogenetically from fish to man. The evidence from various morphological indices of brain evolution and the experimental studies of brain damage is overwhelming in its affirmation of the importance of such nervous tissue in the mediation of intelligent behavior.¹⁵ The final step in Fig. 5-14, corticalization of function, refers to the further differentiation and specialization of nervous tissue, namely the localization of psychological functions within certain portions of the cerebral cortex. The most obvious examples of this are the highly localized sensory and motor functions within the cortex of man. Removal of the occipital cortex, for example, results in complete blindness, in spite of the in-

¹⁵ See the chapter on physiological psychology for more details on brain-behavior relationships. One important point is that the size of the brain increases in proportion to the increase in cerebral projections of the various bodily functions. Brain-weight/body-weight or brain-weight/spinal-cord-weight ratios seem to be more accurate indices of brain evolution than the gross weight of the brain.

Fig. 5-14 The brain from fish to man. These brains are pictured as the same length so that the smaller ones will show adequate detail. Their relative size may be gathered from the following approximate weights, given in grams: man, 1500; gorilla, 400; dog, 130; rat, 2; pigeon, 2.2; and dogfish, 3. The cerebrum (C) not only gets larger but it also gains in proportion to body weight. In the dogfish there is no cerebrum, but comparable structures are indicated by the arrow. The gorilla is much heavier than man, but his brain-weight is only one-fourth of man's. Note also the invaginations shown in the dog's brain. These are more pronounced in the gorilla and human brains. The smell brain, so prominent at the left of the three lower brains, undergoes a recession in higher brains. Cb is the cerebellum. Note its prominence in the pigeon, which of course exhibits behavior notable for its complex coordinations. (From Munn, 1951, p. 49.)



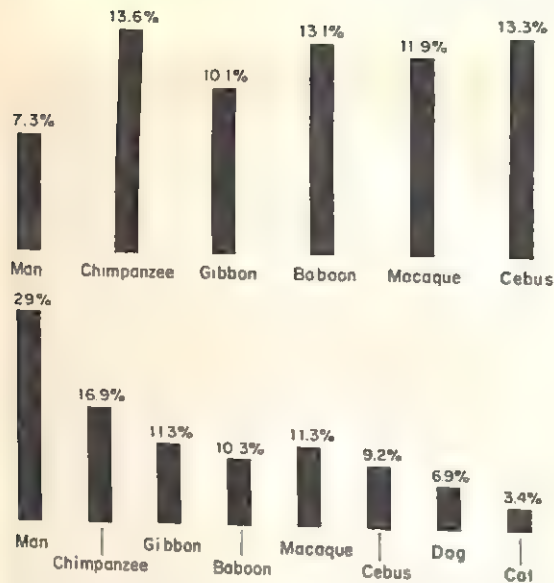


Fig. 5-15 Graph prepared from data recorded by Brodmann, illustrating the relative extent of the prefrontal area (all of the frontal lobe except areas 4 and 6), expressed in percentage of the entire surface area of the cerebrum. (From Bucy, 1935, p. 552.)

tactness of the non-cerebral optical system. Similarly, damage to the motor cortex results in paralysis of specific peripheral musculature. There is considerable evidence that such corticalization of intellect is most likely to occur in the non-sensory areas of the brain, particularly in the frontal lobes. The neuro-anatomical development of the frontal lobes is reflected in the following two figures. Fig. 5-15 shows the relative extent of the mammalian prefrontal area expressed as a percentage of the surface area of the brain. Fig. 5-16 shows that the area has increased not only in proportionate size, but also in the complexity of neural structure.

While the evidence is incomplete the implication is that such structural changes reflect parallel behavioral changes, thus the theoretical implication that man's cerebral cortex, particularly the frontal lobes, holds the key to his intellectual functioning. Various brain damage experiments lend plausibility to this argument. Research on the spatial delayed response, for example, localizes this function in the frontal pole area of the brain. The bases for numerous other problem solving tasks, including a variety of puzzle boxes, instrumentation problems (e.g. the use of rakes of varying length to pull in the food reward), and

difficult discrimination tasks, have been localized in the frontal lobes. While other research, such as Klüver's findings on visual agnosia and Kretschewsky's spatial versus visual "hypotheses" have pointed to the importance of the parietal and temporal lobes, the bulk of the evidence points to the frontal lobes as the primary mediator of intellect. Harlow's long range studies are typical of the brain-behavior research which supports this hypothesis. He presents the monkey with a wide variety of problem solving tasks variously described as multiple choice, matching from sample, concept formation, oddity problems, etc., and finds that the monkey is incapable of such tasks after removal of frontal brain tissue. The experimental set-up for the oddity problem, for example, is indicated in Figs. 5-17 and 5-18.

What are the implications of all this regarding the intelligence of man? Figure 5-13 indicates an essential continuity in the evolution of intelligence until we come to man. At that point the figure suggests a discontinuity which is either attributable to missing links which would eventually fill in the gap, or to a true qualitative jump from subhuman to human. The comparative approach favors the continuity interpretation and suggests that we suspend judgment before making a final decision. Regardless of the present discontinuity in the available evidence the comparative trend toward increased differentiation of nervous tissue is consistent with the encephalization and cortical localization of psychological function. This finding, combined with the multi-factor theory of intelligence based on studies of human intellect, suggests that there is some kind of parallel or interaction between the differentiation of nervous structure and the differentiation of intellect.

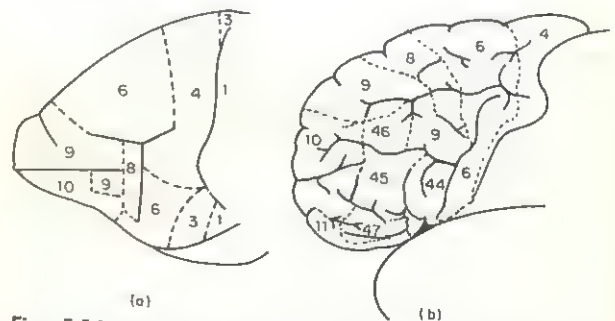


Fig. 5-16 Schematic drawings of the cyto-architectonic fields of the frontal lobe (A) of the monkey and (B) of man. (Adapted from Bucy, 1935, p. 555.)

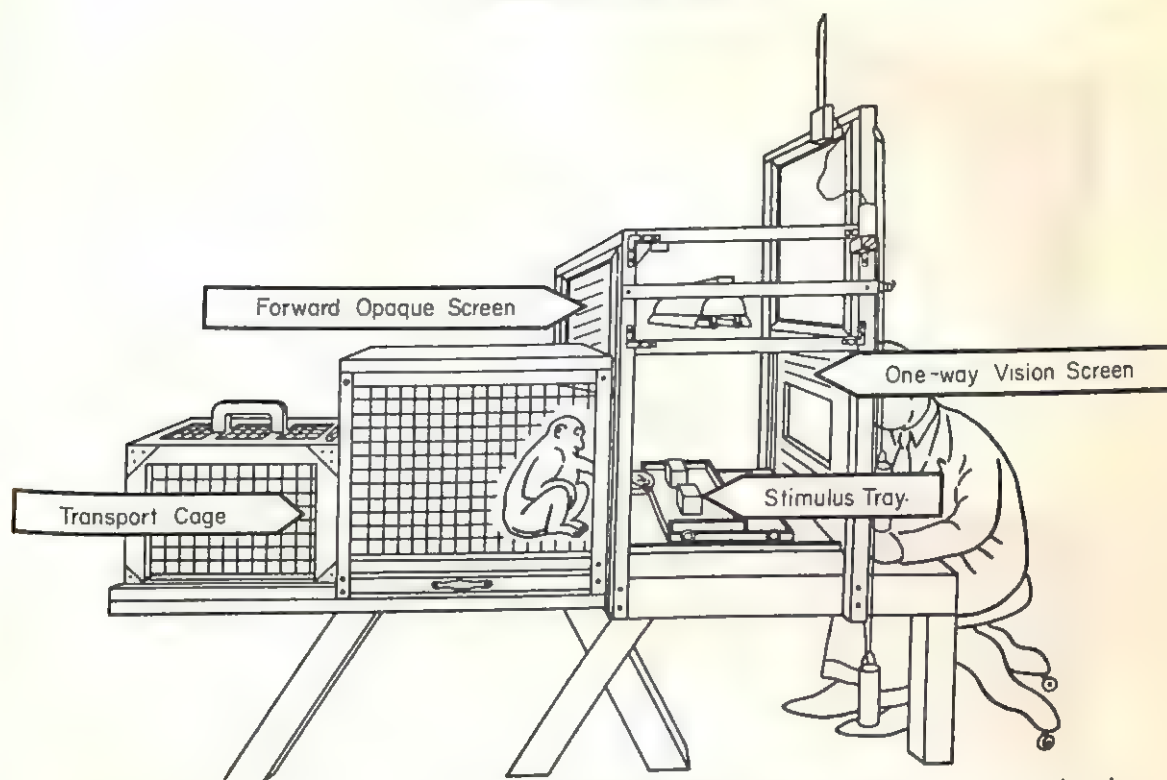


Fig. 5-17 The Wisconsin Test apparatus used with monkeys. While the stimuli are arranged and the well under one is baited, the opaque screen is lowered. The test tray is then moved toward the animal and the screen is raised. A one-way-vision screen eliminates cues which the monkey might get from watching the experimenter. When it pushes the correct form aside, the monkey can obtain food from the well beneath it. In some such tests, the animal is not allowed to respond to the other stimulus after a mistake. The tray is withdrawn or the screen is lowered. This test situation is used to investigate a variety of discrimination problems, as well as matching and delayed reaction. (After Harlow, 1951, as reproduced in Munn, 1955, p. 135.)

THE EXPERIMENTAL PRODUCTION OF ABNORMAL BEHAVIOR IN ANIMALS

Questions revolving around normality and mental health have not been adequately answered either theoretically or empirically. There is even serious doubt that the medical model which underlies the notion of mental illness is the most fruitful theoretical framework. In spite of this conceptual chaos, clinical psychologists and psychiatrists are called upon to diagnose people in mental hospitals. This means they must make judgments, regardless of the inadequate state of present knowledge, regarding the normality or abnormality of emotionally disturbed people. The key characteristic common to the several varieties of abnormality is that the behavior of persons labeled abnormal is, for whatever reason, essentially maladaptive. It is also typical for such mal-

adaptive emotional behavior to be generalized and persistent as opposed to being specific and transient in nature. While recent investigators on abnormal animal analogues for such human adjustment mechanisms as reaction formation, displacement, regression, repression, anxiety, and masochism, we shall confine ourselves to the more undifferentiated condition known as "experimental neurosis." This term should be taken to mean any abnormal condition rather than its more restricted meaning, as when it is applied to human behavior. In the material which follows, then, we shall focus on any relatively persistent and generalized maladaptive behavior which is experimentally produced by exposing an animal to stress of some kind. It should be kept in mind that the ultimate motivation behind such investigation is to follow



Fig. 5-18 The oddity tests solved by monkeys. Shown above is one form of the oddity test, where the monkey must move the odd object, regardless of its color, shape, position, and the nature of associated objects. In the lower illustration is shown a form of the Weigl principle oddity test. On a cream-colored tray (left) the odd form is correct, whereas on an orange-colored tray, the odd color is correct. (H. F. Harlow, "Primate Learning," in *Comparative Psychology*, 3rd ed., Calvin P. Stone, ed., © 1951. By permission of Prentice-Hall, Inc.)

it with experimental treatment studies as well, with the hope that we will eventually learn enough to apply such knowledge to the human condition.

THE USE OF CONDITIONING PROCEDURES TO PRODUCE ABNORMAL BEHAVIOR

The great Russian physiologist Pavlov accidentally discovered the conditioned response while studying digestion; he also accidentally observed the first case of experimental neurosis while studying the conditioned response. According to the phenomenon of stimulus generalization a wide range of stimuli in a given class (e.g., any sound, such as a buzzer, bell, a clang, a dull thud, etc.) can serve as the conditioned stimulus even though the *S* was originally trained to react to one particular stimulus (e.g., the buzzer). On the other

hand, the concept of stimulus discrimination says that the organism will respond positively to that stimulus which is sufficiently reinforced, and will extinguish his response to non-reinforced stimuli. For example, dogs can be trained to exhibit conditioned responses to tones from a relatively small portion of their total audible range. It was in the process of pushing such stimulus discriminability to the limit that Pavlov and his colleagues uncovered the phenomenon of experimental neurosis. In this case they were studying the dog's ability to discriminate between a circle and an ellipse. After establishing a *CR* to the circle, they presented a very flat ellipse. Subsequent trials involved making the circle more elliptical and the ellipse more circular until the animal was no longer capable of discriminating.

Such forced, fine discrimination resulted in a highly emotional, non-adaptive, and persistent state, which was described by Pavlov (1927, p. 291) as follows:

The hitherto quiet dog began to squeal in its stand; kept wriggling about, tore off with its teeth the apparatus for mechanical stimulation of the skin, and bit through the tubes connecting the animal's room with the observer, a behavior which never happened before. On being taken into the experimental room the dog now barked violently, which was also contrary to its usual custom; in short, it presented all the symptoms of a condition of acute neurosis. On testing the cruder differentiations they also were found to be destroyed, even the one with the ratio of the semi-axes 2:1.

Subsequent studies by Liddell and his co-workers at the Cornell Behavior Farm have demonstrated similar behavior in sheep and goats, and furthermore, have added to our understanding of experimental neurosis, particularly as it relates to psychosomatic accompaniments. For example, these investigators have been able in experiments to induce high blood pressure, irregular breathing and pulse rate, unpredictable eliminative responses, neurotic hypersensitivity, and general restlessness.

Other studies have used a conditioned stimulus to signal the onset of a noxious stimulus. The signal is randomly paired with the noxious stimulus, so that the noxious stimulus accompanies the signal only a certain percentage of times. It should be noted in passing that this procedure differs from avoidance conditioning in that there is no way for the *S* to avoid the noxious stimulus; he can only anticipate it and eventually accept it. Such a procedure has been shown to induce a high state of anxiety in animals. The level of hydrochloric acid in the stomach is substantially raised, usually terminating in ulceration of the stomach and death if carried out long enough.

THE USE OF "CONFLICT" TO PRODUCE ABNORMAL BEHAVIOR

The distinctive feature of the conflict technique is the presence of an insoluble problem in the experimental procedure. It is commonly assumed that motivational conflict or the simultaneous presence of contradictory behavior tendencies is a major causative factor in human neurotic reactions. The first experimental demonstration of the no-solution conflict situation involved a simple

brightness discrimination task in a modified Lashley jumping stand (see Fig. 5-19).

The experimenter, N. R. F. Maier, first trained the rat to discriminate between a black circle on a white background and a white circle on a black background. After the discrimination was well established by rewarding the animal when he chose the black circle, the investigator then introduced new conditions in such a way as to allow no choice for *S*. For example, the previously rewarded black circle, as well as the white circle, was henceforth accompanied by punishment rather than reward—that is, both cards were mounted in such a manner that they would not fall, even if the previously designated "correct" card was chosen by the animal. The punishment comes from the fact that the rat bumps his nose on the stationary card upon impact, then falls into a net below. Many animals react to this experimenter-induced frustration by refusing to jump, even though they are strongly motivated by hunger. On subsequent trials, after forced jumping by electrical shock or a blast of air, the investigator removed the previously blocked doorway to food. At this juncture the neurotic rats exhibited a behavior pattern designated as abortive jumping—that is, jumping in a sidewise manner so that they could not possibly land in the open doorway. It should be noted that these animals are highly motivated by hunger when they exhibit this behavior, and further that it continues to occur for some time, even when food is placed in plain sight at the open doorway. The most extreme behavior reported by Maier was a manic-like seizure, involving staccato movements and tics, followed by a depression-like, comatose state, during which the animals could be "molded" by the experimenter into a variety of positions which are impossible with a normal rat.¹⁰

The psychiatrist Masserman is the central figure in a second major series of research efforts in-

¹⁰ Maier's work on experimental neurosis was initially hailed as a milestone in the short history of experimental psychology. Subsequent research, particularly by C. T. Morgan, questioned the conflict basis for experimentally induced convulsions, and offered an audiogenic seizure interpretation instead. Although the waters are still somewhat muddled regarding the original Maier experiments, recent research on conflict and audiogenic seizures has made it clear that both mechanisms are effective in the production of abnormal behavior in animals.

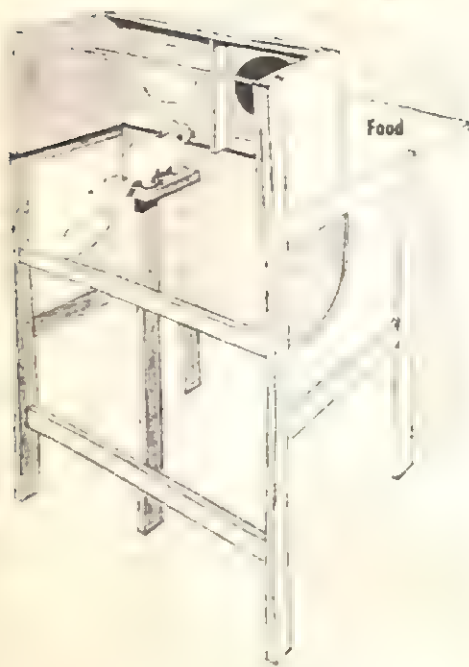


Fig. 5-19 Apparatus used to study discrimination and conflict in rats. When the rat jumps against the correct stimulus, he proceeds to the food platform beyond. A jump against the incorrect stimulus, which is locked from behind, brings a fall into the net below. The stimuli are shifted in position, in a chance order, from trial to trial. (After Lashley.) In the top picture at the right, a correct response is shown. The card falls and food is obtained. The lower picture shows an incorrect response. After the position of the cards has been changed, the rat bumps its nose and falls into a net. (From Munn, 1961, p. 364.)

vestigating the similarity between animal and human responses to conflict. The essence of Masserman's technique is as follows: cats are initially trained to open the lid of a box for food and then shocked or blasted with air as they approach or open the box. The animals typically respond with much wild clawing, running, and subsequent refusal to eat.

Several investigators have challenged Masserman's interpretations, arguing on the basis of their data that the behavior of the cats is not maladaptive, and that the presence of the aversive stimulus alone is sufficient to produce the behavior (i.e., that conflict per se does not have to be present). Other investigators, on the other hand, are convinced that a more thorough analysis of the nature of conflict is the key to our understanding

of psychopathology. N. E. Miller (1944), for example, describes three types of conflict.

1. *Approach-avoidance*. In this situation the subject has strong tendencies to approach and avoid the same goal simultaneously. Miller and his co-workers observe that when a rat has been fed and shocked at one end of a runway, he will approach the goal and then stop and move away, return toward the goal, then away, etc., vacillating in his behavior, theoretically indefinitely.

2. *Avoidance-avoidance*. In this situation the subject has strong tendencies to avoid simultaneously all available choices. This type of conflict is illustrated by the behavior of the rat which has been shocked at both ends of a straight alley. The animal typically vacillates at a point roughly midway between the two aversive goals.

3. *Approach-approach*. In this situation the subject has strong tendencies to approach simultaneously all available choices. This situation is illustrated by the animal which has been fed at both ends of a straight runway and is placed in the middle. This type of conflict seems to be more resolvable than the previous two.

Miller offers the following four principles as basic to an understanding of conflict behavior:

1. The tendency to approach a goal is stronger the nearer the subject is to it.
2. The tendency to go away from a place or object avoided is stronger the nearer the subject is to it.
3. The strength of avoidance increases more rapidly with nearness than does that of approach.
4. The strength of the tendencies to approach or avoid varies with the strength of the drive upon which they are based.

This kind of analysis, which is essentially an attempt to understand psychopathology in terms of the principles of learning theory, lies behind the recent therapeutic attempts known as behavior therapy (see p. 253). In particular, the approach-avoidance type of conflict situation has been proposed as the key to experimental neurosis (e.g., see the Masserman experiments for an obvious example of simultaneous approach-avoidance behavior).

THE USE OF AUDITORY STIMULI TO PRODUCE ABNORMAL BEHAVIOR

The distinctive feature of investigations included in this category is the use of some form of intense auditory stimulus. The simplest apparatus for producing audiogenic seizures is a washtub and a doorbell which can be attached to the inside of the tub. The animal is placed in the tub, the bell rung, and when rats are the experimental subject, the seizure ensues in 65 per cent to 70 per cent of the animals.

The seizure itself occurs in a predictable pattern, as follows. It begins with wild running activity which is much faster than ordinary running. Some animals may then stop running and stand upright with their backs strongly arched. At this stage the animal begins generalized muscular spasms, rolls on its side or back, and exhibits rapid running movements of its legs for a short time.

This is followed by the animal drawing its legs up against its body and then extending the rear legs as far as possible, with its ears flattened against its head and its eyes closed. If the animal does not recover at this stage, it will die. Recovery is characterized by a series of slow gasps, followed by rapid respiration, twitching of limbs, righting, and shock (lethargy, loss of orientation, etc.).

Both Munn (1950) and Finger (1944) review in detail the important factors in producing audiogenic seizures in the rat. In outline form they are:

1. Stimulus factors. High frequencies are most effective, but loudness will compensate for low frequency. Also, continuous sound is more effective than intermittent sound.
2. The evidence indicates that 65 per cent to 72 per cent of a random sample of rats respond with seizures.
3. Sex. Slightly greater male susceptibility.
4. Age. Although varying with other factors, there is apparently a curvilinear relationship between susceptibility to seizure and age, with the period of maximal susceptibility falling between 30 and 60 days in rats.
5. Genetic. Though the hereditary basis of susceptibility to seizures is well established, the means by which this susceptibility is genetically transmitted is not yet clear (e.g., see the genetic evidence as it relates to the mouse, pp. 74-75 of this chapter).
6. Dietary deficiency. Increased susceptibility is shown in animals whose reduced caloric intake has produced a slight inanition and in animals deficient in Vitamin B₁ and B complex, with or without caloric insufficiency. Moreover, treatment with Vitamin B may reduce or totally eliminate susceptibility. Finally, and somewhat contradictorily, inanition beyond a certain degree may reduce the incidence of seizures.
7. Drugs. Attempts to use drugs to identify the neurophysiological basis for seizures have produced no conclusive results. Dilantin has been shown to reduce seizures significantly.
8. Brain lesions. No generalizations are possible in this area.

ATTEMPTS TO ALLEVIATE FUNCTIONAL ANIMAL DISORDERS

Beginning with the early work of Pavlov and Liddell, investigators have been concerned with

eliminating the disorders of behavior produced by their experimental procedures as a potential source of new ideas and procedures for therapeutic change in the disturbed human being. Both Pavlov and Liddell attempted the most basic form of treatment with their animals, i.e., simply removing the animal from the experimental situation for a period of time. They note that although the symptoms may have disappeared during the period of rest, they quickly reappear when the animal is reintroduced into the experimental situation.

Masserman used several kinds of therapeutic technique with his cats, including forcing the animals to come into contact with the physical focal point of their conflict either by pushing them toward it or by depriving them of food until they were literally forced by their hunger to approach the food box. This was accomplished with the food box plainly open. The initial reaction to this forced contact is in the form of more strenuous and active responses which, in the absence of the confirming shock or blast of air, are alleged to lead to faster elimination of the avoiding or neurotic behavior.

A second analogue to human therapy is labeled "working through" by Masserman. In this situation cats are initially trained to press a disk which activates an auditory signal which in turn precedes the presentation of food. After mastering this, the cats are subjected to air blasts and shock at the moment of pressing the disk, and the typical behavior described earlier develops. After elimination of the air blast and shock, and as hunger increased, the animals would hesitantly approach the disk, becoming increasingly confident as the absence of noxious stimuli became apparent when the disk was pressed. Eventually, their neurotic abnormalities disappeared entirely.

A third therapeutic approach can best be described as relearning or gradual adaptation. This approach uses situations and stimuli similar to the original frustrating situation, so that the anxiety evoked by the previously fearful stimulus is broken down gradually by degrees through a process of learning and adaptation. This procedure has been shown to be effective with neurotics; its techniques, developed largely by Wolfe (1958), employ the simple principle that those who act abnormally can be taught, usually through counter conditioning or associational procedures, to behave normally. Proceeding on the theory that abnormal

behavior is the result of defective conditioning, the therapist uses techniques which negatively reinforce the occurrence of the abnormal behavior. Such "behavior therapy," as it is called, has been applied to alcoholics. Patients have been given a drink at the same time they were injected with a drug which produces terrifying results, such as being unable to breathe for about a minute. Counter conditioning of a positive variety typically follows the negative conditioning described above in order to reinforce the more desirable behavior.

The psychologist is well aware of how little he knows about psychopathology and how to treat it. However, we have shown that an experimental attack on this problem is possible. Most experiments to date have focussed on how the organism responds to stimulus inputs. They show that a stressful overload can result in a breakdown in psychobiological equipment under at least three conditions: (1) overstimulation, (2) conflict of stimulation, and (3) too fine a discrimination of stimulation. Treatment for "neurotic" breakdowns from these causes is reasonably effective, particularly if it involves all of the following: (1) removal from the stressful conditions, (2) supportive extinction of the originally stressful stimuli by gradual adaptation, (3) gradual re-establishment of the organism's pre-stress level of performance, preferably accompanied by positive counter conditioning (i.e., formation of new habits). These findings represent a significant, albeit meager, beginning to the scientific resolution of an extremely difficult and important human problem.

While it is premature to offer a theory of psychopathology which will adequately encompass the wide variety of behavior patterns characteristic of human and animal abnormality, there are strong indications that the basic principles of conditioning and learning, particularly as exemplified by the original stimulus discrimination study of Pavlov, can account for all three classes of pathology described in this section. As an example, the Russian investigator Krushenskii (1962) has recently presented a convincing case for the interpretation of audiogenic seizures on Pavlovian grounds. The conditioning-extinction hypothesis is certainly the most viable one at the animal level; its implications at the more value laden symbolic level of the human is difficult to assess at this time. If the sign-symbol distinction between animal and

man (e.g., review the first two pages of this chapter) is valid, and if it is also true that human psychopathology is primarily a matter of meaning-affect-symbol confusion (see Royce, 1965), then the animal analogue to human abnormality cannot possibly be adequate. The experimental findings to date have clearly been focussed essentially at the sign (i.e., in terms of sensory inputs) rather than the symbolic level. In spite of this limitation the theoretical linkage between psychopathology, psychotherapy, and learning theory is very promising (see especially Miller and Dollard, 1950, and Shoben, 1949). The answer to such a dilemma can only be to see how far the sign analysis (i.e., via modern learning theory) will eventually take us, while remaining alert to the obvious inadequacies of such an approach.

ANIMAL BEHAVIOR AS A PARADIGM FOR PSYCHOLOGICAL THEORY

The ultimate goal of the scientific enterprise is to evolve what might be termed useful theory—that is, theory which is capable of serving as a basis for subsequent prediction and practical control. Unfortunately, psychology has a long way to go before it can achieve this kind of rigorous theoretical unification. There are a great many reasons for this state of affairs, including the complexity of the subject matter and the relative youthfulness of the discipline. Mature scientific inquiry can be characterized as going through four successive stages: (1) prescientific philosophical speculation, (2) exploratory observation (empirical), (3) experimentation and quantification, and (4) mathematical rationalization and theoretical unification. Psychology has barely tapped the final phase, and can be characterized as being fundamentally empirical-experimental. Whenever it attempts to reach beyond the third stage toward theoretical unification, the complexity of the subject matter rears its ugly head and reminds its practitioners of the sheer difficulty of the task. One consequence of this state of affairs has been a retreat to the study of animals simpler than man, involving relatively simple behaviors and simple experimental conditions.

While a wide variety of behaviors and species have been studied, systematic psychologists have focussed their energies on the laboratory rat and the phenomena of conditioning and learning. The

rat as the animal of choice is based on the usual advantages of availability, inexpensiveness, and maintainability, combined with its propitious location at the lower end of the mammalian series. That is, the fact that it is mammalian provides the obvious tie to man, and the fact that it is lower mammalian considerably reduces the degree of psychobiological complexity. The focus on learning is related to the obvious docility and adaptability of the rat and the early success of the behaviorists in providing psychology with an observable unit of behavior, the conditioned response. This research strategy of simplification or idealization of the phenomena to be studied is, of course, an old tactic, in the history of science. The physicists invoked such a strategy when they postulated a theoretical vacuum, the biologists did it in their early observations of heredity by studying the sweet pea and the fruit fly, and mathematicians accomplish similar aims by invoking simplifying assumptions. The logic is to get leverage on a complex domain of knowledge by the detailed analysis of a simpler model. Thus, the systematic psychologist has argued that a theory of how the rat learns relatively simple tasks, such as pressing a lever and navigating through a multiple unit maze, should provide us with the foundation for an eventual theory of human learning.

THE RAT AND LEARNING THEORY

The concept of reinforcement, particularly as exemplified in Skinner's (1938, 1953, etc.) research on operant conditioning, and extended under a variety of reinforcement schedules, provides an excellent point of departure. Operant conditioning refers to the reinforcement of an emitted or non-stimulus induced response, in contrast to the more familiar elicited, respondent, or classical (i.e., Pavlovian) conditioning. Examples of operant behavior include the spontaneous movements of an infant, eating a meal, driving a car, and writing a letter. In fact, it is any non-stimulus associated behavior which is subsequently reinforced. Although the concept of operant conditioning has wide ranging implications at the human level (see especially Skinner, 1953), the experimental simplification of the behavior in question involves the pressing of a lever in order to gain a food reward (see Fig. 5-20a). Skinner has found that the cumulative recording of the rat's lever pressing activity as a function of time provides a highly

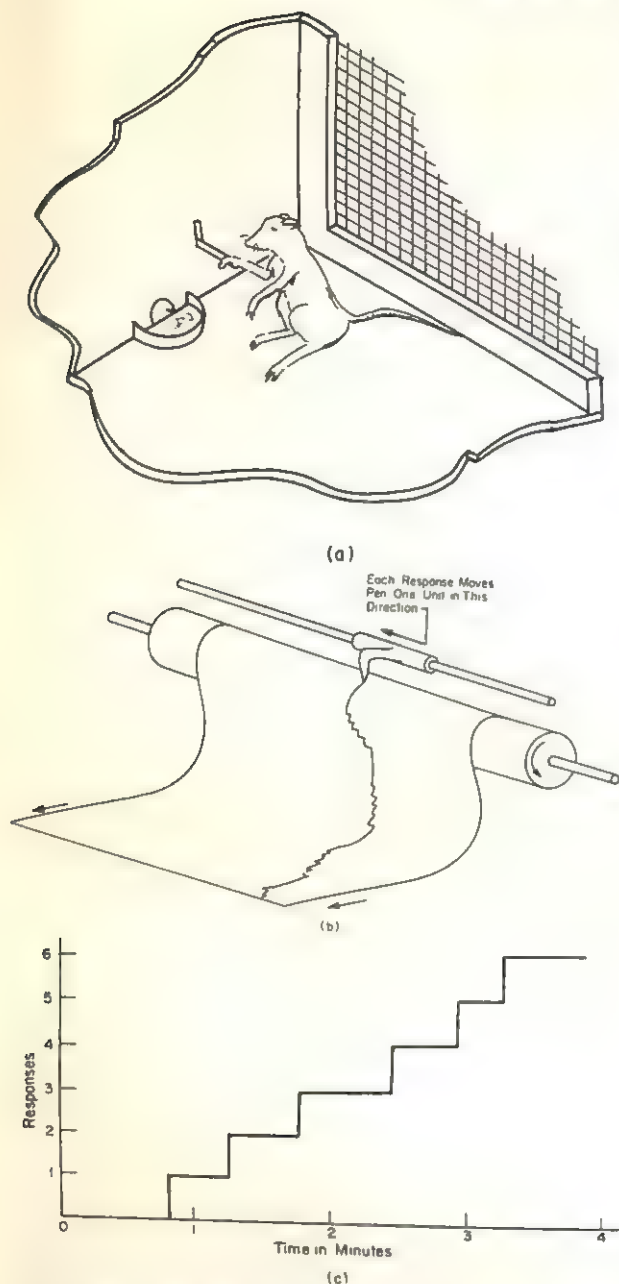


Fig. 5-20 The automatic recording of operant conditioning. (a) Skinner box. Pellet of food is automatically released in the food pan each time the lever is depressed. (From Harlow, as reproduced in Andrews, 1948, p. 327.) (b) Diagram of a cumulative recorder. (From Ferster & Skinner, 1957, p. 24.) (c) Illustrating the construction of a cumulative record of bar-pressing responses. (From Keller & Schoenfeld, 1950, p. 43.) (B and C by permission of Appleton-Century-Crofts.)

stable and predictable unit of behavior. He obtains records of such behavior by the use of an

inkwriting mechanism which moves horizontally across a continuously moving paper each time the rat presses a lever (see Fig. 5-20b). The resulting record is apparent by inspection of Fig. 5-20c. A record showing no lever-pressing activity would result in a straight line in the same direction as the moving paper; a record showing a high level of lever-pressing activity would result in a slightly wavy line almost perpendicular to the moving paper. Depending on the speed the paper is moving, most records would fall somewhere between these two extremes.

When lever pressing is followed by a food reward the animal's behavior is reinforced, thereby resulting in an increment in the rate of responding. Variations in the rate of reinforcement, referred to as reinforcement schedules, have differential effects on behavior. For example, it has been experimentally determined that continuous reinforcement (the reinforcement of every response) is more effective than intermittent reinforcement (the reinforcement of a proportion of the total number of responses) in the acquisition of operant behavior, but that intermittent reinforcement is more resistant to extinction. There are also pre-

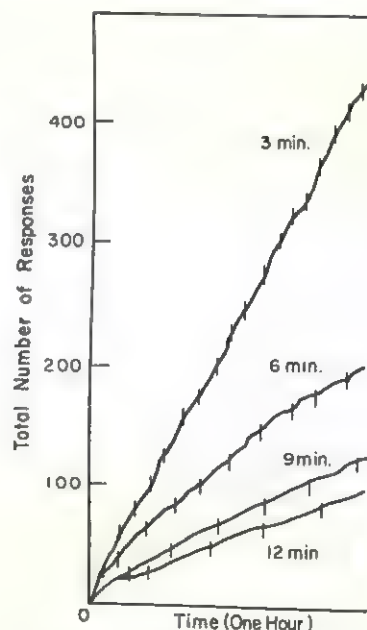


Fig. 5-21 Responses within one session of fixed-interval reinforcement. A pellet was delivered every 3, 6, 9, and 12 minutes, respectively. The more frequent the reinforcement, the more rapid the rate of responding, although each rate is relatively uniform. (After Skinner, 1938. By permission of Appleton-Century-Crofts.)

dictable effects from varying the schedule of intermittent reinforcement. For example, in the study summarized in Fig. 5-21 a pellet of food was delivered every 3, 6, 9, and 12 minutes, respectively. These data show an increase in slope as the time interval decreases, reflecting an increase in rate of responding as the reinforcements become more frequent. This type of intermittent reinforcement is referred to as an interval schedule. The experimenter can also provide reinforcements after a specified number of responses, thereby introducing a ratio schedule. Depending on whether conditions are kept constant (fixed schedules) or are experimentally varied (varied schedules), there are four basic reinforcement schedules: fixed interval, variable interval, fixed ratio, and variable ratio. For still further complications of reinforcement schedules, see Ferster and Skinner (1957). For example, they describe the tandem schedule, which involves a shift from one of the four basic schedules to one of the remaining three schedules. They also describe chaining, multiple schedules, mixed schedules and interpolated schedules. The hope is that experimental juxtaposing of basic processes will eventually account for more complex behavior.

But Tolman (1932) has pointed out that *S-R* units or parameters or reinforcement, although adequate as conceptual building blocks for the understanding of relatively simple learning tasks, such as lever pressing, discrimination tasks, and mazes, are inadequate for the more human-like tasks which require insight or understanding. He makes an appeal for cognitive or perceptual restructuring as central to the learning process, and has focussed his experimental energies on tasks which require considerable ingenuity for the rat to negotiate. One such situation is demonstrated in Fig. 5-22. In preliminary training the animal becomes thoroughly acquainted with all three pathways to the foodbox. When all paths are open the typical response is to take path 1, the shortest route. When block A is introduced the rats take to path 2. The crucial test comes when the investigator moves the block from position A to position B. The rats are not "taken in," as they now choose path 3 immediately, without wasting trial and error runs along path 2. Tolman's interpretation of this kind of performance is that the rat behaves in accordance with a "hypothesis" or "cognitive map" regarding the situation.

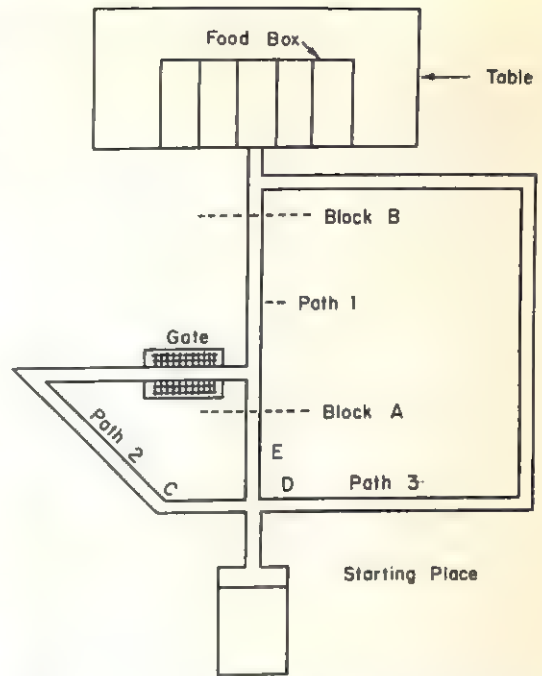


Fig. 5-22 Maze used to test insight in rats. The paths become established as a hierarchy according to length, Path 1 preferred to Path 2, Path 2 to Path 3. If Path 1 is closed by Block A, the rats run by Path 2. If Path 1 is closed by Block B, the rats run by Path 3 if they have "insight" that the barrier closes Path 2 as well as Path 1. (From Tolman & Hoznik, 1930.)

Whereas many learning theorists, such as Skinner and Tolman, have contributed ingenious experimentation combined with the inductive generation of theoretical concepts with wide generality, relatively few theorists have been able experimentally to demonstrate confirmation of quantitative deductions from a formal network of constructs. The theorist who has been most successful in the endeavor to date is Clark Hull (1943, 1951, 1952).¹⁷ Out of a system of some seventeen postulates and a similar number of corollaries, Hull makes certain deductions and hypotheses. The concepts of "habit-family hierarchy" and

¹⁷ The early attempts of Thurstone, Gulliksen, and Rashevsky to quantify learning were merely demonstrations of possibilities. Recent efforts to apply mathematical models, such as those of Spence, Seward, Estes, Burke, and Bush and Mosteller, have already demonstrated tight empirical "fits" to theoretical predictions. See Hilgard (1956) for an introduction to mathematical models of learning theory and see Logan (1959) for the most recent extension of Hullian learning theory.

"goal gradient" represent examples. A habit-family is a hierarchical set of alternate habits, each of which is capable of leading to the goal. Goal gradient refers to the prediction that responses nearer to the goal will be more strongly conditioned than those farther removed. In the case of a multiple-unit maze, for example, this principle implies that blind-alley choices near the goal will be eliminated before such choices nearer the beginning of the maze.

A relatively simple example of a Hullian deduction comes out of the research on latent learning. Latent learning refers to learning which has occurred without reinforcement and which subsequently manifests itself upon the introduction of a reward differential. Hull's theoretical prediction follows from merely combining two previously demonstrated elementary principles. The first one (Postulate 4) states that "reaction potential" (designated $S^E R$) is a monotonic increasing function of the number of reinforcements (assuming a reinforcement occurs on every trial, that trials are

evenly spaced, and that all other variables are held constant). The second principle (Corollary viii) refers to the multiplicative effect of incentives or rewards on habit strength or reaction potential. This appears as a constant (K) in the growth function cited above. The coalescence of these two principles is brought out in the graph in Fig. 5-23. This graph shows shifts between the low incentive curve (labeled $K = .6$) and the higher incentive curve (labeled $K = .9$) as a function of the value of the constant K . It should be obvious that this relationship actually generates a family of curves, depending on the value of K .

While most of the research on learning theory has been conducted on animal subjects, the successes to date have encouraged investigators to extend their studies and speculations to human subjects. Thus, there is now a massive collection of human data on the various parameters of the conditioned response and rather complex forms of learning including, for example, verbal learning

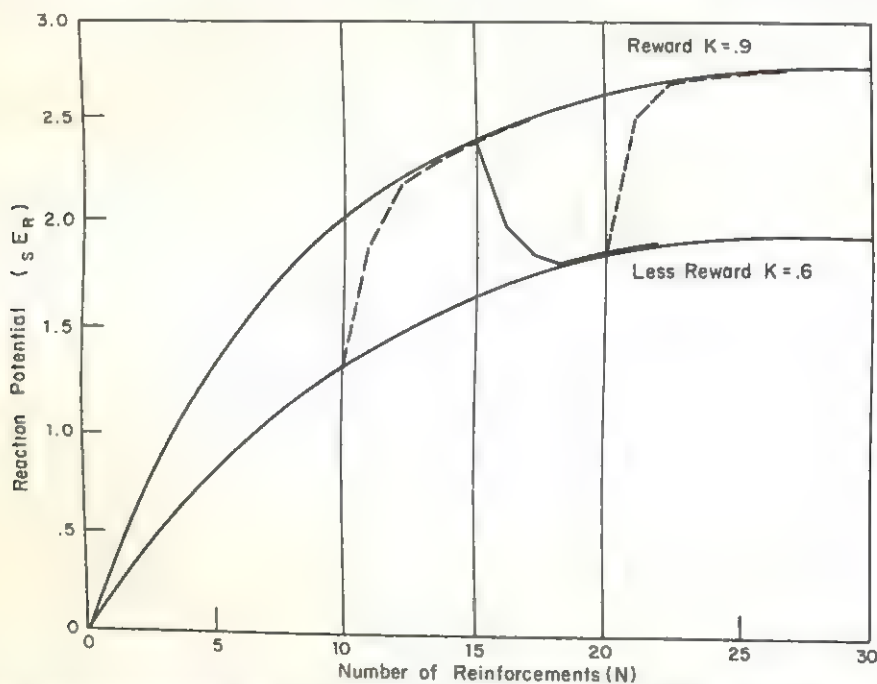


Fig. 5-23 Hull's theoretical prediction of latent learning. The upper curve represented the course of learning with a large incentive ($K = .9$) throughout. The lower curve shows the course of learning with a smaller incentive ($K = .6$). The first curve that crosses between the two predicts what will happen if the incentive is increased at trial 10 for animals previously trained with the smaller incentive (the typical latent learning result). The next two crossings represent the result of a decrease in incentive at trial 15, and an increase at trial 20. (After Hull, *A Behavior System*, Yale University Press, 1952, p. 144.)

(e.g., see Kimble, 1961). Furthermore, these extensions are leading to practical applications in such diverse arenas as programmed learning (via teaching machines), psychotherapy, and "experimental cultures."¹⁸ Such developments suggest that research on animal behavior will continue to be an excellent testing ground for the generating and confirming of principles of behavior.

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¹⁸ For example, see Skinner (1953), especially Chapter 28, *Designing a Culture*, and *Walden Two* (Skinner, 1948), a utopian novel in the vein of science fiction à la Aldous Huxley (1932) and George Orwell (1949).

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CHAPTER 6

Child Psychology

The main aim in child psychology is to understand children through studying what they do, think, and feel as they move through the childhood years, why they develop as they do, and how best to promote their welfare. Another aim is to understand adults, for an adult's attributes—his disposition and character, his abilities, his attitudes regarding himself and others—have their roots in childhood. This latter aim is most richly fulfilled if an adult, in studying child psychology, not only gains in his understanding of others but also acquires a deeper understanding of himself.

Child psychology as a body of knowledge includes an aggregation of facts about the characteristics of children at various levels of growth. It also includes a number of general principles. The first section of this chapter will deal with six concepts which are especially important for child psychology.

SOME MAJOR CONCEPTS

THE "INNER" AND "OUTER" WORLD OF CHILDHOOD

To understand children it is essential to take account of both the *objective* and the *subjective* dimensions of their lives. The objective dimension consists of everything that is visible in their physical makeup, observable in their overt behavior and measurable through tests of their abilities. These aspects of children's lives are the ones we ordinarily respond to in our everyday dealings with them.

The subjective dimension consists of all that transpires in the child's "inner world" of thoughts, feelings, motives, and impulses. This represents what might be called the private, as distinguished from the public, domain of the child's life. It includes all that goes into his awareness of the external world—as he perceives it—and all that is embraced in his awareness of his own existence.

From all that we can judge, the child at first does not have a clear awareness of details in the world about him, or of the outer and inner boundaries of his experience. Within the first weeks

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and months after birth a child makes great strides in discriminating between details in his environment. His awareness of the nature of the world in which he lives continues to expand and to become more clearly defined throughout the childhood years. Signs of a growing awareness of himself as a separate entity appear during the first half year of life, and at about the age of one year he probably has established the firm beginnings of awareness of his own identity (Ames, 1952). The development of his ideas and attitudes about who and what he is continues as long as he lives.

As time passes, there are varying degrees of correspondence and discrepancy between the objective reaches of a child's life as viewed by others and the subjective reaches that are directly known only to himself. For example, at age four he is aware that a bigger child is hitting him, he feels the pain, he feels angry and he shows anger by hitting back. In this episode the public display of anger and the private experience of it are merged into one configuration. However, if he feels the pain and feels angry but is afraid to show it and instead conceals it with a smile, there is a discrepancy between his overt and his covert response. As children grow older there usually are increasing discrepancies of this kind, especially in connection with their emotional experiences.

A child's subjective reactions have a reality for him even when these are out of keeping with objective reality. For example, a child fears a goblin in the cellar of his home. The goblin exists only in his imagination, but to the frightened child this fear is as "real" as if a dangerous creature actually lived in the cellar. Again, a child who feels unfairly treated perceives his mother's actions and intentions as being unjust. From his point of view, his mother actually *is* unfair even though from the point of view of the mother or any impartial observer she is as fair as any mother could possibly be.

Ausubel and his associates (1954) point out that while a parent's behavior is an objective event in the real world, it affects the child "only to the extent and in the form in which he perceives it. Hence, perceived parent behavior is in reality a more direct, relevant, and proximate determiner of personality development than the actual stimulus context to which it refers."

A child's view of himself, like his view of his associates, may or may not be in accord with

"reality" as seen by others. Moreover, his view of himself and his reaction to the world about him are based not only on conditions he is aware of but also on conditions he is unaware of, unable to explain either to himself or others. When a child is afraid of a goblin he is acutely aware of his fear but he is unable to explain what this fear means or consciously to reconstruct the chain of events that gave rise to it. The fear is part of the child's *known* experience, but its origin and meaning are in the realm of the *unknown*. This means, in effect, that there are not just two, but three dimensions of a child's world: the objective, as earlier pointed out; the subjective, embodying all that he is aware of in his known, conscious existence; and conditions he is not aware of, frequently referred to as unconscious.

THE INDIVIDUALITY OF BABIES

Each child has characteristics in common with all other human beings, but he also is an individual, distinct from all others. How this comes about is the major riddle of child psychology. But one fact does stand out, namely that normal full-term infants have their own individuality almost from the time of birth. During the first five days of life, while still in the hospital, babies differ in the intensity of their response to stimulation, such as a sound, or a cold object brought into contact with their skins (Birns, 1963). Even at this early age there is a high degree of constancy from day to day in the responses shown by each child. From early infancy babies differ in the extent to which they are irritable or placid, active or relatively quiet; they differ in the vigor of their demands for food, in their tendency to become excitable and in the ease with which, once excited, they can be soothed and return to a quiet state.

A child's individual characteristics not only appear in the way he responds to others, but they also influence the way others respond to him. Mothers who have reared two or more children are aware of this. "Boarding mothers" with two or more infants awaiting adoption likewise note that practices that work well with one baby may not be suited to another baby (Berezin, 1959).

In an investigation by Chess, Thomas and associates (Chess *et al.*, 1959, 1962; Birch *et al.*, 1962; Thomas *et al.*, 1961; and Thomas, 1962), babies were observed and their behavior was rated periodically, beginning in early infancy.

Ratings on a three-point scale were made in terms of nine categories of behavior which the investigators called "primary reaction patterns." The categories were:¹

1. Activity Level—High, Medium, Low
2. Rhythmicity—Regular, Variable, Irregular (in connection with routine daily events, such as feeding, sleeping, elimination)
3. Approach-Withdrawal—Approach, Variable, Withdrawal (in response to new or different stimuli, such as the first feeding of orange juice, or at a later time, their first haircut)
4. Adaptability—Adaptive, Variable, Non-Adaptive
5. Threshold of Responsiveness—High, Medium, Low
6. Intensity of Reaction—Intense, Variable, Mild
7. Quality of Mood—Positive, Variable, Negative
8. Distractibility—Yes (Distractible), Variable, No (Non-Distractible)
9. Attention Span and Persistence—Yes (Persistent), Variable, No (Non-Persistent)

A child's reaction in terms of all of these categories was called his "adaptive style." Comparisons between ratings at various periods during the first two years of life showed a significant level of constancy.

Similar evidence of individuality and consistency of response in infancy and early childhood was noted in an earlier study by Shirley (1933b). Findings in several recent studies strongly support a conclusion by Shirley to the effect that each baby, although his behavior changes as he matures (e.g., a decline in crying and irritability, an increase in self-assertiveness) is likely to continue to show "identifying earmarks" and remain "true to type." Findings also support Shirley's view that each child is born with a "tough core" of temperamental qualities (1941).

The individual characteristics of babies influ-

ence their elders in a variety of ways. It is easier, for example, for a mother to deal in a relaxed way with a placid child than with a child who is "fussy." The mother of an irritable child is more likely to become tense and anxious than the mother of a child who is serene. A mother must employ much more ingenuity and patience in introducing solid foods (or any other innovation) to a child whose primary reaction pattern is to withdraw, rather than to approach, when presented with something new.

MATURATION AND LEARNING

A child begins his career as a learner at the time of birth and perhaps even before. Learning plays a crucial role in his development. It is through learning that a child adopts the habits, customs, and values characteristic of the culture in which he is reared. It is through learning that he acquires the specific intellectual skills that mark him as a rational creature. His standards of right and wrong, justice and beauty are acquired through learning, as are his loyalties and prejudices.

Maturation is also an important factor in determining the changes that occur in the course of development, and in determining a child's capacity to learn. The term "maturation," as here employed, denotes any change in capacity or performance which depends primarily on growth as distinguished from practice or learning. A child's organic immaturity sets limits on what he is able to learn or to do at any particular juncture of his growth and, by the same token, the process of maturing enlarges the scope of his ability to learn. At birth he is organically an unfinished creature. His cerebral cortex is incompletely developed at birth, and the same is true of many other structures of the body, including muscles and bones.

Many of the early effects of maturation are apparent in the sphere of motor development. When born, a child involuntarily grasps an object that comes into contact with his palm. Later, with the maturation of his nervous system, the grasp reflex gives way to voluntary grasping. Up to a given point of physical development, no amount of coaching will enable a child to sit alone or to creep or to walk. But as he matures he becomes ready to practice and master these performances. This does not mean, however, that maturation thrusts a full-blown skill on a passive organism.

¹ Many other categories have been used to describe and rate extremes and gradations of personality traits at the infancy and (more frequently) at the preschool or later levels, such as: dependency-non-dependency; aggressiveness-non-aggressiveness; dominance-submissiveness; introversion-extroversion; high-low frustration tolerance; conformity-non-conformity, etc.

In order to creep, for example, a youngster must have an opportunity to get into a prone position on a fairly hard surface so that he may practice using his arms and drawing up his knees into a creeping position. Likewise, to stand or to walk he needs an opportunity to practice. When given such opportunity the healthy child undertakes such practice of his own accord.

The role of maturation is important also in a child's intellectual development. A child who, having had the best possible encouragement, begins to talk at thirteen months could not have done so at six months. In the process of growth the mind matures in the sense that under optimum conditions the older child can master intellectual tasks which he could not master when he was younger, or can perform intellectual tasks more efficiently.

It is important to scale a child's training to his own growing capacities. This promotes efficiency in learning and it spares the child from the effects of avoidable failure. It does not help, and may do harm, for example, to train a child for bladder control when he is organically too immature to acquire it. Similarly, if a youngster, within a few days or weeks at the age of ten can master a certain performance at school (such as long division) which he had been unable to master through strenuous effort at an earlier time, it would be far more prudent to delay this task until the child seems to be "ready" for it.

Unfortunately, relatively little research has been undertaken to determine the juncture in a child's growth when, through the process of maturation, it is likely to be most timely to teach and to demand that he learn various intellectual skills and academic subjects.

HEREDITY AND ENVIRONMENT

A child's development and his personal characteristics are a product of interaction between his heredity and his environment. In the fertilized egg with which his life begins there are twenty-three pairs of structures known as chromosomes; one of each pair is contributed by the father and the other by the mother. The chromosomes contain minute substances known as genes which constitute the child's genic or genetic endowment. These genes interact with one another and with the environment in complex ways.

The effects of genetic factors are quite obvious in connection with the child's physical develop-

ment, his skin color, body build, height (Bayley, 1954; Eichorn, 1959), and other bodily characteristics. The environment also obviously influences physical growth—a good or poor diet may produce differences in physical stature. Even identical twins (from the same fertilized egg cell) sometimes differ appreciably at birth in height, weight, and physical vigor due apparently to prenatal environmental conditions (Shields, 1962).

In the intellectual sphere, children obviously need an environment that stimulates the use of their minds in order to realize their intellectual potentialities. Children who have suffered from neglect and deprivation in overcrowded, poorly equipped, and poorly staffed orphanages have become intellectually more alert and enterprising when transferred to a more favorable environment (Skeels, Updegraff *et al.*, 1938). However, when reared in a generally favorable environment children still differ in their mental ability, as measured by intelligence tests, due to differences in heredity.

One of the most impressive studies that demonstrates the influence of heredity is a long-term investigation of children who were separated from their parents as infants and reared in adoptive homes. When tested in their early teens there was a significant correlation between the children's IQ's and the intelligence of their "true" mothers from whom they had been separated as infants. (The correlation was .38 on the basis of tests with a 1916 version, and .44 on the basis of the 1937 version of the Stanford-Binet test.) But there was practically a zero correlation between the intelligence of these adopted children and the educational status of the adoptive parents (Skodak and Skeels, 1949).

The fact that heredity plays an important role in determining the level of intelligence is also underscored by comparisons between identical (monozygotic) twins. Identical twins usually show much higher similarity in intelligence than fraternal twins or siblings, even when they have been separated as children and reared in different homes. In the most extensive study in this area, Shields (1962) made a number of comparisons between forty-four identical twins who had been brought up together in the same home and forty-four who had been separated in childhood and brought up apart. (These twins, incidentally, were drawn from 5000 twins who volunteered in-

formation about themselves after an appeal had been made in a British television program.) It was possible to obtain intelligence scores under proper test conditions for thirty-seven pairs reared apart and thirty-three pairs reared together. The correlation between mental test scores of twins who had been brought up apart was .77. (This correlation is almost as high as would be found if scores made by a group of individuals on one form of a mental test were correlated with scores made by the same individuals on another form of the test.) The correlation between scores of those brought up in the same home was .76; and the correlation between scores of fraternal twins was .51. There was a large variety of differences between the environments of the separated twins, but these did not produce differences in intelligence that might have been expected. According to Shields, "From an analysis of family structure, social background and a number of other factors of possible importance psychologically, intelligence seems to be singularly little affected by the various differences in environment" (p. 111).

In personality development the role of environmental factors is most apparent in children who are neglected, rejected, and deprived. The influence of genetic factors is usually more obscure and harder to measure. Yet this influence is seen, for example, in similarities between identical twins. Shields (1962) found an "almost equally close resemblance" between the forty-four pairs of identical twins who had been separated and reared in different homes as between forty-four pairs reared in the same home (p. 155). If one of a pair of identical twins has a mental illness diagnosed as schizophrenia the chances are high (about 70 to 80 in 100) that the other member of the pair will be similarly afflicted, even if they have been separated and reared in different homes (Kallman, 1953). By contrast, if one of a pair of fraternal twins has the illness the chances are much lower (about 14 in 100) that the other twin will also have it.

Within the normal range of personality development, the interaction between environmental and genetic factors is more difficult to establish. The fact that children differ in irritability, alertness and vigor at birth does not, in itself, mean that genetic factors are responsible. Their behavior may be influenced by conditions affecting the

mother during pregnancy or birth, such as some forms of illness, drug addiction, and mishaps that produce brain damage in the child. However, when children differ in traits such as those described in our discussion of individuality in babies, in ways that cannot be explained by any known differences in children's environment prior to, during, or immediately after birth, the likelihood is strong that the differences are due to genetic factors.

As a child matures, inherited physical characteristics may indirectly influence his personality development through the effect these characteristics have on his view of himself and through the way they influence others. Among these characteristics are some that appear in adolescence, such as early or late sexual maturing. (Inherited physical characteristics that influence an adolescent's popularity, self-confidence, and self-esteem will be discussed in the next chapter.)

GENOTYPE AND PHENOTYPE

Each child has manifest characteristics as well as latent genetic potentialities. The term *phenotype* denotes all that is apparent in a child's makeup at a given juncture of his growth. The phenotype is a product of interaction between genetic and environmental factors, but it may also include features that are due primarily to the environment (for example, a child may be thin because he is malnourished, not because of an inherited condition). The *genotype* embodies the sum total of a child's genetic endowment—including potentials that will be manifest later in his growth (such as growth of public hair in adolescence) or which do not show forth in his phenotype during his lifetime but may still be transmitted to his offspring.

A discrepancy between the phenotype and genotype may occur when the two sets of genes a child inherits from his two parents are unlike in their potential effects, as when a youngster gets genes that produce brown eye-color from one parent and blue eye-color from the other. In such a situation, one gene or set of genes may be *dominant*, the other *recessive*. When both are present in a fertilized egg cell the dominant one prevails over the recessive one: its effects are the ones manifest in an offspring's phenotype. A child whose genes

contain determiners for both brown and blue eyes is likely to have brown eyes, for dark eye-color is usually dominant over light eye-color. If this person mates with a person who has a similar heredity the following combinations of genes are possible in the fertilized egg: brown from both, brown from one and blue from the other, blue from both. The first two of these will produce brown-eyed children; the blue-blue combination will result in blue-eyed children.

Many hereditary defects are carried by recessive genes. For this reason an hereditary defect may "skip" several generations and then appear unexpectedly.

TRANSITORY AND PERSISTING MODES OF BEHAVIOR

During the course of development some forms of behavior flourish for a time and then give way to different forms; others, by contrast, when once established, become firmly fixed.

Among the behavior patterns that wane are some that are displaced or supplemented by other patterns in the process of maturation. In the normal course of growth some reflexes that were present at birth disappear. Other changes include a shift from creeping to walking as a favorite form of locomotion, and a shift from sucking to chewing in the feeding process. When a child in the creeping stage climbs up an incline he uses the creeping pattern—he pushes himself upward and forward by gripping with his toes—but when he has reached the walking stage his toe-grip weakens and he depends more on his arms.

In many spheres of activity successful and satisfying repetition leads to a more and more strongly entrenched habit, but when the factor of maturation is at work a child will change from one way of behaving to another with relatively little difficulty. In their language development many children use "dat" for a period and then, when they are capable of the *th* sound "dat" changes to "that." In their writing children usually begin with a rather laborious shaping of separate letters and then later readily make a transition from discrete movements to a more flowing, rhythmic, cursive style.

Other forms of behavior that are prominent

for a time and then recede appear in bursts of activity a child displays when on the brink of testing and mastering a new performance. A child who is practicing his ability to raise himself to a standing position may become so absorbed in this occupation that he insists on being fed while standing. When walking is being established some will walk, tumble, walk again and again even when they are cranky with fatigue. When children have reached the "questioning stage" even a simple statement of fact, such as "It's raining," may elicit a series of "why's." Youngsters when in what has been called the "first negative phase" (which might better be called a phase of enthusiastic self-assertion) will go on a binge of obstinacy, resisting innocuous suggestions and commands, contradicting what is said to them. After a time they become more tractable. Such "all-out" preoccupation also frequently appears in connection with food preferences and play activities.

Among the forms of behavior which, when once established tend to become fixed, are countless habits and skills. Also among these are attitudes and personality traits that are, so to speak, self-nourishing. For example, a child who for one reason or another has acquired a feeling of being abused may perceive an offense where none is intended; this interferes with his freedom to enter into friendly give and take, and if he openly shows his feelings others are likely to respond to him in ways that confirm rather than dispel his grievance. Shyness offers another example: when the shy child hesitates to approach others, and also makes it difficult for others to approach him, he reinforces his shyness.

Attitudes that show a high degree of persistence and self-perpetuation include those relating to a child's view of himself. Among these are attitudes of pride or shame, self-confidence or the lack of it, healthy self-esteem or irrational self-reproach, a realistic appraisal of personal qualities or irrational feelings of inferiority. When once established, such attitudes are very tenacious. The self-confident child is free to venture into achievements that give him further assurance of his ability to manage his affairs. The child who lacks confidence does not have this freedom. A youngster who has a healthy regard for his own worth will take mistakes in stride, but a youngster with

a low opinion of himself is likely to regard his mistakes as further evidence that he is not much good.

INDIGENOUS MOTIVATION

During infancy and early childhood a youngster furthers his own development by a vast amount of spontaneous activity. He demonstrates the principle of indigenous motivation: inherent within a growing capacity is an impulse to use that capacity. Examples of this were mentioned in the preceding account of children's eagerness to try a new venture, such as standing and walking, and their efforts to satisfy their curiosity with an outpouring of questions. The same principle is illustrated in children's language development when they babble, repeat sounds and words over and over again, and experiment with the meaning and pronunciation of new words which they add to their vocabulary. (A child who was experimenting with new words in the author's hearing managed to get the word "recognize"—at first pronounced "rek-nee-ize"—into his conversation ten times within half an hour.)

In all aspects of their intellectual, social, and motor development, children undertake a vast amount of learning of their own accord. They will even experiment with ways of overcoming their fears.

As children grow older a great many of their activities do not have a self-propelling quality. This is, to a large extent, inevitable because much of their activity is governed by rules and many of their daily tasks are repetitive and routine. However, there is a loss of spontaneity also in connection with activities that once were and potentially might remain self-motivating.

As children move on in school a large proportion of them seem to lose the intellectual curiosity that was so noticeable at an earlier age. The loss of eagerness is especially noticeable in late elementary years and in the high-school years. This loss is probably due at least in part to the way things are taught at school and to the artificial incentives that are used. School subjects are quite commonly presented as the finished product of someone else's long years of study rather than in a manner geared to a youngster's own way of learning. The ideas and events taught to the beginner in history, for example, are to a large extent alien to the youngster's interests and ways

of thinking. The contrast between a child's way of learning and the way he often is taught is conspicuous in the mastering of a foreign language. A youngster thrown in with playmates who speak another tongue is able in a remarkably short time to converse in the new language. He would not make such rapid progress, however, if he were required from the beginning, as in some schools, to study rules of syntax and the conjugation of regular and irregular verbs.

THE GROWING CHILD

At birth a child is still incomplete, not at all a miniature version of the man he is to be. Many developments that were occurring during the prenatal period continue after birth, as though his transition from the womb to a separate existence of his own were only an incident in a continuing process. Yet, at birth, he possesses a great repertory of abilities, and although he looks and is very helpless, he soon comes forth as a distinct and unique little person in his own right.

Among his important accomplishments at birth is an ability to suck. His impulse to suck—through which he gets his sustenance—is so strong that it may be set off not only when an object is brought into contact with his mouth but also by stimuli which give little promise of nourishment, such as a pinch on his toes. The line of communication within his nervous system seems to be put together in a haphazard fashion, yet with proper help from his mother, it functions very well.

The child's world at first is a limited one, but it begins to expand almost at once. A hungry child who at first would cease his crying only when placed at the breast or the bottle soon learns to respond to signs and symbols. His crying momentarily ceases when he hears a click in the door-latch, or the sound of his mother's voice. By responding to a sound the infant displays that economy of the mind which enables a child to respond to symbols and cues, and eventually to employ symbols in elaborate thought processes.

EXPANDING HORIZONS

The child at first is what has been called a "sensorimotor" creature. He is bound to what is here and now, and immediately available to his sense organs. There is at first a close interaction

and interdependence between his mental and motor abilities, notably his ability to use his hands. Much of his early exploration of his environment occurs by manipulation of objects that lie within reach. As time passes his growing motor abilities enable him to move into a widening sphere of activity. The range of his observation is greatly increased when he is able to sit, hold his head erect, and rotate his head. There is a further expansion when he is able to creep and to walk.

Throughout early childhood years a child continues to use his hands as an important adjunct to his mental development.² He combines learning with doing. However, during the first year of life he becomes increasingly capable of what might be called "mental manipulation" as distinguished from manipulating with his hands. This can be seen when he makes searching movements to locate and recover an object that has fallen out of sight and reach.

During early childhood years there is also a close interrelationship between his intellectual and his social and emotional development. The child's growing mind receives much of its nurture through his relationships with others. It is through association with others that the youngster learns to use language, to ask questions, and to formulate thoughts into words that others can understand. A very important accomplishment in the child's intellectual development is his learning to read. Most normal children have important "prereading" experiences that prepare them later to read from a printed page (Almy, 1949). Among these experiences are scribbling, looking at pictures while seated in a parent's lap, learning to recognize street and roadway signs and labels on grocery packages.

As time goes on a child's ability to reason, acquire, and apply logical ideas is, to an important degree, not only an intellectual but also a social accomplishment. One aspect of the development of reasoning is making a transition from egocentric to socialized thinking (Piaget, 1928; 1959;

Inhelder and Piaget, 1958). A child thinks egocentrically when his ideas are formulated entirely in terms of his own point of view and he is unable to view things from the standpoint of another person (or from the standpoint of an abstract proposition or general principle). A child is egocentric when, for example, while facing another person he correctly points to his own right hand when asked, "Show me your right hand," but then, when asked by this other person to "Show me *my* right hand," he points to the hand directly opposite him (the left), not realizing that right and left denote relationships that are independent of his own right or left side.

There also are many interrelationships between intellectual and emotional development. For example, the fears a child experiences are determined not only by physical encounters with conditions which might or might not be dangerous. When a child intellectually is able to perceive and distinguish the difference between the strange and the familiar, he may show fear of a strange person who previously would not arouse fear. An interesting facet of the interrelation between intellectual and emotional development is that bright children show some common childhood fears at an earlier age than youngsters who are not so bright (Holmes, 1935).

TRENDS IN CHILDREN'S THINKING

Among the developments in children's thinking as they move from infancy into later childhood are the following:

1. An increased ability, appearing at an early age, to discriminate between objects and events they encounter in their daily lives and to perceive and to identify an ever increasing range of objects and circumstances.
2. An increasing ability to deal with concepts and eventually to think in terms of abstractions.
3. An eventual ability, in thinking about natural phenomena, to grasp the idea that certain laws or principles remain invariable in spite of changes in form, spacing, appearance, and other characteristics.

In a series of classic studies, Piaget notes that a child's ability to grasp the idea of *conservation* represents an important milestone in the development of his ability to think. A child *conserves* the concept of quantity, for example, when he realizes that the amount of water remains the

²The close association between mental and motor activities accounts to a large degree for the fact that scores on intelligence tests administered during early childhood do not give as accurate a prediction of what a child's IQ will be as tests administered during late preschool years. The earlier mental test items depend on motor ability (such as fitting round or square pegs into a peg-board) to a greater extent than the verbal or paper-and-pencil test items used with older children.

same whether it is poured into a tall beaker or a flat dish, and the amount of clay remains constant whether pressed into one lump or broken into many pieces. He grasps the principle of conservation of number when he understands, for example, that the number of blocks removed from a basket remains constant whether they are piled in one heap or stretched out in a long line. A youngster also applies the principle of conservation when he realizes that certain properties of matter remain constant in spite of distracting appearances, *e.g.*, although large objects usually weigh more than small ones, a large cork will float in water but a little piece of iron, with higher specific gravity, will sink.

4. Ability eventually to make logical deductions from an abstract principle, to apply a theory, to test an hypothesis, and to retrace the steps in thinking that intervene between raising a question and reaching a conclusion. According to Piaget's findings, it is not until about the age of eleven or twelve that a child typically is able to make pure deductions and master the concept of cause and effect.

IMAGINATION, FANTASY, MAKE-BELIEVE AND DREAMS

A child's imagination—his capacity for make-believe, daydreams and fantasy formation—occupies an important place in his mental life. Children begin to undertake imaginative activities as early as the first year of life. As they grow older they are able through make-believe to go places, do things, play roles, acquire possessions and companions, express a variety of emotions, in a manner that would not be possible in real life. In his make-believe he can control the actions of others. He can express anger without fear of retaliation.

One function of make-believe is to enable the child to deal vicariously with conditions in his life, including emotional problems, which he cannot master on a reality level. This function is served when a child uses imaginative activities as a means of coping with fear. A child who is afraid of dogs may, for example, play with an imaginary dog (Jersild and Holmes, 1935b) as though seeking, in a safe manner, to face her fear. Similarly, a child who is afraid of noisy trucks may choose a toy vehicle as his favorite plaything (Griffiths, 1935).

It appears that dreams as well as daydreams serve a useful purpose. Many children who report that they have unpleasant dreams still maintain that they would rather continue to have dreams than to be rid of them. It is as though they dimly realize that even a troubled dream can have value. A study by Dement (1960) of "dream deprivation" supports the view that dreams are useful. Applying a discovery that dreaming, while in process of occurring, is accompanied by rapid eye movements, Dement awakened laboratory subjects when instruments showed they probably were dreaming. Persons whose dreams were thus interrupted made more "dream attempts" than they previously had made during the course of a night, and showed more irritability and anxiety on days following dream deprivation. Forced awakening during periods of nondreaming did not produce these effects.

MEMORY

A child's ability to remember plays an important role in his thinking and it also provides him with a record of his own personal history, a record that is significant for him even though it is sketchy and incomplete.

Children show many evidences of remembering during the first year of life. In early childhood they have a vast number of transient memories which then are forgotten. Older persons usually do not remember childhood experiences occurring before the third year, and even then these "early memories" are scanty as compared with events that actually transpired during and prior to that period.

As measured by what he is able to recall unaided, the typical older child, adolescent, or adult is out of touch with a very important segment of his life. And even the fragments he does recall may be distorted or colored by his present mood and outlook on life. (The writer has elsewhere (1960) given a more extended account of findings in this area.)

INTELLECTUAL ABILITIES AS MEASURED BY INTELLIGENCE TESTS

Among the facets of mental development that have been studied most exhaustively are those measured by intelligence tests. Findings indicate that after about the age of four or five children's

intelligence quotients show a high degree of constancy from year to year. However, even within a fairly uniform environment there are individual shifts in scores, sometimes quite large, over a period of time. Changes in IQ as a consequence of a changed environment are likely to be more substantial when children are transferred from a very poor to a better intellectual environment than when they are transferred from a reasonably good environment to one that is supposed to be intellectually more stimulating and challenging (Skeels, Updegraff *et al.*, 1938; Pritchard, Horan and Hollingworth, 1940).

Important new developments in the area of mental testing stem from studies conducted by Guilford (Guilford, 1950, 1959; Guilford and associates, 1951, 1952, 1960). Through analyses of the structure of intelligence, Guilford identified "five major groups of intellectual abilities": (1) cognition; (2) memory; (3) convergent thinking; (4) divergent thinking; and (5) evaluation. The distinction between convergent and divergent thinking is especially significant. Convergent thinking is defined as thinking that "leads to one right answer, or to a recognized best or conventional answer." Divergent thinking, on the other hand, involves "thinking in different directions, sometimes searching, sometimes seeking variety." Divergent thinking is more flexible, original, less bound by convention, more imaginative, less controlled by preconceived rules of logic, more venturesome. Divergent thinking is essential for creative thinking.

Guilford's work has stimulated a great amount of research into what might be done to define, measure, and promote creative thinking. It appears that the standardized tests which have been used to measure intelligence place more emphasis on convergent than on divergent or creative thinking. Current evidence suggests that those who stand highest on tests designed to measure creativity are also likely to be well above the average in conventional intelligence tests, but there may also be large discrepancies between scores on the two types of tests. Findings by Torrance (1962) indicate that teachers emphasize convergent thinking considerably more than divergent thinking. Findings in studies by Getzels and Jackson (1960) indicate that teachers seem to show greater preference for pupils who are in the "high IQ" group than for those in the "high creativity" group.

SOCIAL RELATIONSHIPS

Each child is both a creature and a creator of the society in which he lives. At first he is dependent on the care he receives from others, and if neglected he will wither away. But from the beginning the social world in which he resides is structured by himself as well as by others.

RELATIONS WITH PARENTS

The child's first "society" consists primarily of himself and his mother—or the one who serves as his mother.³ In his relations with his mother the infant not only requires physical care and protection but also, very soon, he needs (or at least wants) something more: he seeks bodily contact and, as far as his abilities permit, he invites and welcomes cuddling and tries to snuggle. In a celebrated study of infant monkeys—who seem in many important respects to behave like human infants—Harlow (1958) noted that babies reared by artificial mothers spent far more time clinging to a soft terry-cloth "mother" than to one made of wire even though they received their milk from a wire "mother" equipped with an artificial breast. According to Harlow, the "contact comfort" a baby derives from a mother is more important than the mother's milk in the development of affectional responses.

Although all babies welcome affection, they differ in the extent to which they seek and accept cuddling. In due time, for example, one bottle-fed youngster seems much to prefer to be cradled in his mother's arms when fed, while another, of similar age, reaches from his crib for the bottle and seems to prefer to remain there, tilting the bottle and feeding himself. However, all children who are normally reared obviously enjoy the presence of an adult or familiar older person, and the child's first smile is likely to be elicited by the sight of an adult.

As the youngster grows older and more enterprising, he uses the nearness of an adult as an anchor and source of security while venturing out

³ The "primal" society consists of three if there are twins. Burlingham (1952) has noted that even when twins are biologically "identical" (monozygotic) their social environment from the start may not be identical. Although the mother may be equally devoted to the two, there still will be a difference in her dealing with them if one twin, for example, is more robust and vigorous in demanding food.

into an enlarging sphere of activity. Strange objects, faces, and noises are not as frightening if a parent is near. Young children often show fear when they lose sight of their parents, especially in a strange place. Many youngsters at the toddler stage go through a period of turmoil when parents go out and leave them with a baby-sitter (this turmoil often combines elements of both fear and anger).

The young child's response to motherly care, and the distress many children show when separated from their parents, has focused a great amount of attention on the role of mothering in a child's development. Special interest has centered on the effects of institutional as compared with home care on a child's development. Some writers have reported findings that paint a dire and even tragic picture of the impairment children suffer from being reared in an orphanage. It is difficult, however, to evaluate these findings for studies in this area have usually not adequately taken account of factors, other than institutionalization, that might influence the child's development, such as his genetic background and crises or traumatic happenings in the home that made it necessary to place the child in an institution.

Other investigators have noted that orphaned young children thrive better in a well-staffed and well-equipped institution than in a poor institution, but even in a poor institution children do not typically suffer from emotional trauma (see, e.g., Dennis, 1960). The present consensus of those who have methodically studied this matter probably would be that a good institution (which means appropriate facilities and, above all, a sufficient staff of humane persons) is better than a poor home where a child is deprived, neglected, and abused.

An example of the effects of deprivation in an orphanage that was understaffed and poorly equipped is reported in a study by Dennis (1960). The children spent a large amount of their time on their backs in small cribs on soft mattresses. These children were unable to creep when children normally creep: the reason was that they were unable, at this stage, on their soft bedding, to swing themselves from a supine to a prone position. It appeared that these children might have crept normally if attendants had regularly lifted them from their soft beds on to a hard floor.

Parental Acceptance and Rejection. During recent years, the concepts of parental acceptance and parental rejection have been used to explain practically everything that goes well or amiss in children's development.

Parents who are accepting of a child are pleased to have him; they are able to enjoy his ways (although they are often baffled, annoyed, and weary); they respect him as an individual; they make allowance for his immaturity; they are on guard against using him to gratify their own competitive strivings. A child who is thus accepted and basically approved by others is helped to acquire accepting and approving attitudes regarding himself.

By contrast, a child whose parents' basic attitudes are rejecting faces many hardships. He must fend for himself while still weak and in need of emotional support. Disapproved, even when he does the best he can, he lives on a constant diet of failure. Under such circumstances it is difficult for him to acquire healthy attitudes of self-confidence and self-approval.

The concept of parental rejection is useful for understanding children who are retarded or troubled, but it has been used quite indiscriminately in recent years. The concept has been invoked to explain all kinds of human misfortune ranging from colic, or running noses, or poor eating habits, to failure at school, premarital sex activity (by girls), early marriage (by girls), delinquency and mental illness. The label of "rejection" has been applied not only to parents who are obviously derelict but also to parents who seem to be doing the best they can, including parents who were sufficiently interested in their responsibilities to participate voluntarily in research studies.

The label "rejecting parent," loaded with condemnation, has been bandied about so loosely that large numbers of decent parents feel guilty and anxious (the author and his associates have noted this in several informal inquiries). Such guilt and anxiety is less likely to help parents than to prevent them from applying their own goodwill and common sense. Parents are particularly susceptible to the accusation of being rejecting because, in point of fact, every parent is to a greater or lesser degree a rejecting parent. He cannot and should not yield to a child's countless demands. He must

set limits, lay down rules, apply discipline. (If he yields to every whim and overlooks every foible, his youngster is really headed for trouble.)

Whether or not a child feels accepted or rejected depends not only on parents' attitudes and intentions, but also on the child's perception and interpretation of his parents' conduct. An older child may, for example, feel so strong a need for approval from his parents, and so strong a need to approve of them, that he sees them as more loving and noble than they really are (May, 1950). On the other hand, he may also see them as more rejecting and disapproving than they are (Jersild, Lazar and Brodtkin, 1962).

Parental rejection cannot be regarded as the factor causing a child's misfortune unless a host of other factors have been weighed, such as hereditary or congenital weaknesses; personality traits and temperamental qualities that might make the youngster difficult to rear, no matter how loving and wise his parents might be; the influence of a child's peers and of adults outside the home; the role played by the school; the mores of the community. Few of those who have made pronouncements about rejection have made a thorough inquiry into the complex variables that might have determined or contributed to the conditions rejection has been invoked to explain.

RELATIONS WITH PEERS

The child is usually quite versatile in his relationships with adults before he learns the rudiments of getting along with his peers. His first satisfactions and disappointments occur in his dealings with adults. But it is with his own age-group that he must eventually cast his lot and establish his worth as a person.

If a child is one of several siblings he has had a considerable amount of experience with youngsters near him in age before he strikes out into the society of his peers. In these earlier experiences he may have come to regard other children as friendly and protective (if, for example, he has a "motherly" older sister or brother) or as rather unpleasant characters (if, for example, he feels jealous of a younger sibling, or if he is teased or bullied).

When children first enter into social relations with their peers outside the home their initial interchanges are likely to be fleeting and tentative.

At first there is a good deal of watching and of "parallel behavior," as distinguished from genuine social interaction. As time passes, there is an increase in enterprises in which children act in chorus rather than as separate performers, and with further time they enter into activities which are governed by rules of the game.

In the social interactions between children there is a tremendous amount of learning—learning roles: learning who is *it*, as in hide-and-seek; learning to accept defeat in a competitive game; learning to be a good sport. In this process there often is a contrast between what a child accepts from his elders and from his peers.

Group pressures and the example of peers bring the child into a large range of experiences beyond those he has at home. This is very important in a child's development. These pressures do not always, however, work to the child's advantage. For example, a child who at home has been encouraged to regard schooling as a valuable thing may, under the spur of children of a different background, feel that he should rebel against school.

Children's Friendships. It is important for children to be accepted by their peers but, for some, even more important is a companionship with one or two close friends. Even during preschool years some children are able, with good fortune, to establish a relaxed, seemingly effortless, gratifying relationship with a trusted friend.

At the preschool level, and more noticeably at the elementary school level, children differ greatly in the extent to which they are accepted by members of their group. One way of getting an indication of where a child stands is to apply what is known as a sociometric technique. Children are asked, for example, to name whom they would prefer as seat-mates at school, or as playmates or companions outside of school. This information indicates how often a given child is chosen, who chooses whom, whether or not choices are mutual, etc.

It usually has been found that as children move through the grades there is a large degree of stability in sociometric ratings from year to year: a much-chosen child, or a child who is chosen by few or none at all, is likely as time passes to continue to stand high or low, rather than to show a substantial shift in his standing. Apparently

there are quite stable qualities in children themselves, and in the standards by which they judge one another, that determine these ratings. When children from several elementary schools move on to a junior high school, which throws them among old as well as new acquaintances, they soon achieve ratings in the new group that are quite similar to those in the former group (Laughlin, 1953).⁴

Acceptance by his peers, notably those whose regard he especially cherishes, bolsters a child's acceptance of himself. One of the bitterest experiences of childhood (and later years) is to be an outcast. Persons who are rejected because of race prejudice face a particularly difficult task in acquiring a healthy regard for their own worth (see, *e.g.*, Baldwin, 1963).

EMOTIONAL DEVELOPMENT

At birth children show a great deal of generalized excitement which appears to be "emotional." In the ensuing weeks and months they respond in more specific and organized ways that seem to denote hunger, pain, anger, fear, or delight.

At first a child's emotion is elicited by conditions that impinge directly on his sense organs. As he matures intellectually, and as the range of his interests and activities expands, he becomes susceptible to an ever widening array of conditions, signs, and cues which signify, to him, that his wishes are being furthered or thwarted, or that his well-being is being threatened or enhanced. As time passes, his emotions become involved in everything in which he is involved. Eventually, the most potent emotional stimuli (except in cases of physical emergency) are those that further or threaten his ideas and attitudes regarding himself—his pride, self-esteem, inner conflicts, his cherished ideas about who and what he is.

LOVE AND AFFECTION

The young child at first seeks and welcomes expressions of affection, and eventually, if all goes well, he also has an impulse to bestow affection through pats, caresses, and as time goes on,

⁴ There are exceptions to this, especially if children in a new group apply different standards. An extremely bright child who is regarded as a misfit by a group of average peers may win a higher status if transferred to a group of bright youngsters (Hollingsworth, 1926).

through expressions of tenderness and devotion. One of many signs of a child's capacity for affection is his devotion to pets.

Writers differ in their account of the origins of love and affection. Some regard it as a conditioned response—representing a person's impulse to cherish, protect, and bring joy to someone who has provided comfort and pleasure to him. Others regard the impulse to be loved and to love as part of man's "original nature."

Whatever the source might be, it is clear that human beings have a potentiality for loving. Learning plays an important role in the development of this potential. It seems that it is necessary for a person to receive love in order to be able to bestow it, although how much is necessary is difficult to tell. It sometimes seems that only a few crumbs of affection can keep the capacity for love alive. However, it is possible that the ability to love may be lost after a time if there has been no give and take of a close relationship in an individual's life.⁵

JOY, DELIGHT

Infants give some of their first manifestations of joy by cooing, by expressions of contentment, by the sounds they make while nursing, after the first few desperate gulps have taken the sharp edge off their hunger. A nursing child seems sometimes to be singing a liquid song. Within the first year, children laugh with seeming delight when played with. They also begin to show joy in connection with their own activities. During childhood and later years, successful achievements, especially against odds, remain one of the most potent sources of pleasure. Joy in achievement is especially profound when it involves self-discovery—discovery of an asset or capability, or of ability to cope with a previously disturbing problem (such as a fear).

ANGER AND FEAR

Anger and fear, in their most primitive forms, are survival emotions: they embody an impulse

⁵ Monkeys in Harlow's study (1962), who seemed to thrive as babies when reared by artificial mothers, were cold, ineffectual, or belligerent in response to members of the opposite sex when they grew up, in contrast to the affection shown by normally reared monkeys. Females who finally were induced to mate were "devoid or almost devoid of any maternal feeling" when, for the first time, they became mothers.

to fight or to flee in the struggle for existence. When fully aroused, they include profound glandular changes which augment an animal's brute force—his strength, speed, and endurance when faced with an emergency.

These emotions are in many respects better suited to the life of a caveman than to the predicaments that arise in modern life. The predicaments confronting an older child or adult usually require quick wits rather than physical flight or violent attack. However, even though anger and fear often seem to be overdone and unproductive, they serve important functions in a child's life. His capacity for being frightened renders him more cautious; his ability to fear an anticipated danger helps him to be forearmed; and his fear of punishment frequently (but not always) deters him from harmful exploits.

A child's capacity for anger also serves him in good stead. One important function of anger is to lend force to a child's need to protect his interests, to stand up for his rights, and to assert himself. Anger is especially useful for a child (or older person) who has a tendency to be too meek and submissive but who now and then feels a surge of rage and takes action against those who try to take advantage of him.

Children's Fears. There are several noteworthy developmental trends in children's fears. These are a consequence of the combined influence of learning and maturation. Among the conditions that arouse an infant's fears are sudden, intense, and unexpected forms of stimulation, such as a loud noise which catches a child unawares, flashes of light, or a sudden, unexpected bodily contact. Infants also sometimes show fear of sudden or rapid displacement, such as being carried rapidly downstairs.

As time passes, the range of fear widens. When a child has matured enough to learn and notice the distinction between the strange and the familiar, he may show fear of unfamiliar objects, persons and happenings. At about the age of six months some youngsters for the first time show fear of unfamiliar persons. Even an unfamiliar feature connected with a familiar person will sometimes arouse fear (as when a child is frightened when he notices, for the first time, a heavy layer of cold cream on his mother's face).

Among other fears that arise quite commonly as time passes are fears of animals, strange places,

being left alone or seemingly abandoned. During late preschool years and thereafter, many children have fears of the dark, of "bad" people, supernatural events, death, failure, and disapproval.

In middle and later childhood, a large proportion of children's fears are formulated in terms of anticipated or imaginary dangers—misfortunes or calamities that do not now confront them and have never actually occurred. There is usually a large discrepancy between children's accounts of their fears and their accounts of misfortunes that actually have befallen them (Jersild and Holmes, 1935a). For example, a child views a serious accident on his bicycle as the "worst thing" that ever happened to him, but describes his worst fear or fears as animals that never have threatened him, such as lions and wolves.

Many of the fears described by children are not "fears" from an objective point of view. Rather, the external condition a child fears has a symbolic meaning; it represents his way of expressing or formulating a dread that is largely subjective—a phobia, which is a form of anxiety.

Children's fears represent a great burden of distress. The fears are especially disturbing when they curtail a child's activity. Frequently they invade his mind with a dread that he is powerless to dispel. Phobic fears are especially difficult to cope with. The child himself is unable to explain them, or to take practical steps to cope with them: he cannot wrestle with a ghost or protect himself from a wolf that isn't there.

Most children have fears which they face alone, without help from others. A large proportion of their fears are unknown to their parents (Lapouse and Monk, 1958; Lazar, 1963). This ignorance about their children's fears is not the fault of any particular parent. Rather, it is in part a consequence of massive pressures in our culture that compel individuals, both young and old, to conceal, suppress, and repress their feelings, notably the "negative" feelings of fear and anger. A person (even a very little person) is not supposed to be a "fraidy cat." He is supposed to be big, strong, valiant, "able to take it"; he is not supposed to cry or to cringe but, instead, to put on an act of seeming to be untroubled.

The pressure against showing fear (and thereby having at least some opportunity for examining it) is exerted both by adults and by a child's peers. One form of pressure is to tell a frightened child

that "there's nothing to be afraid of." This is a fatuous statement, for a child is not afraid unless, from his standpoint, there *is* something to be afraid of. His fear, to him, is as real as anything could be (and very unpleasant in the bargain) even though everyone else in the world maintains he has no reason to be afraid. He is, in effect, told that he has no right to be afraid.

Anger. Anger is an essential emotion, but often it produces more problems than it solves. In "handling" his anger a child faces two major difficulties. First, his anger is unpleasant and threatening to others and it invites retaliation. Such retaliation, when he is young, is more likely to occur when he is angry with his peers than when he is angry with his parents. But many parents who are tolerant of a child's aggressive actions against others will not tolerate such actions against themselves. Secondly, the persons against whom the young child's anger is most likely to be directed—his parents—are the ones who care most for him and for whom he is likely to feel the most affection.

The possibility of retaliation brings a conflict between anger and fear; the possibility of hurting a loved person brings a conflict between anger and love. As a consequence, a child has no sooner become able to make a fine display of his anger—first by screaming, later by hitting, biting, pinching, and kicking, and still later by biting language—than he is under pressure, both from others and from himself, to smother his anger. Most children before reaching school age have become accomplished artists in concealing their anger. This can be noticed particularly at school. There are many aggravations at school, including aggravating teachers, but it is a rare child (and woe betide him) who openly lashes out at his teacher.

One way of coping with anger that cannot safely be directed against the actual offender is to displace it—to direct it against a less dangerous target. Children do this when, aroused by the stricter of two parents, they "take out" their anger against the more lenient one. They do it also when they "take out" their anger on a toy, or a younger child, or some other scapegoat.

A more radical way of dealing with anger is to suppress it. One step in suppressing anger is to curb the impulse to *express* it—by seeming unruffled, or by displaying what seems to be the opposite of anger, such as an apparently friendly

smile. A more serious step is not only to suppress the expression of anger but also the feeling. A youngster does this when he quickly concludes that an offender actually did not commit an offense—"he didn't mean it"; "he was tired and upset."

A youngster may also try to suppress his feeling of anger at another by viewing himself as the offender—e.g., "It was my fault." One of the most effective ways of suppressing anger at others is to be swept by a feeling of guilt: it is then the person himself, not the other person, who is being blamed.

The process of suppressing anger is often complicated and long drawn out. Suppression may seem to have been achieved and then break down. Examples of incompletely suppressed anger occur in connection with a delayed response to "stored up" anger, as when a person at the time of provocation felt no anger and then hours (or months or even years) afterward feels a surge of rage. In delayed anger a person sometimes thinks (too late) of a cutting remark, a real "snappy comeback" against someone who earlier had offended him.⁶

The process of smothering anger is carried still further if a person not only suppresses his anger but represses it to such an extent that he disowns it, is unable to feel it. It is difficult to give a convincing account of "repressed" anger, for it denotes anger that has left an aftereffect and yet, as far as the angry person himself is concerned, actually does not exist. We can suspect that there has been a repression of anger when, for example, a person seems obviously to act out a hostile streak, but is not consciously aware of it, and calls his behavior by a noble name (such as righteous self-assertion).

One of the most difficult psychological tasks that faces a person in childhood and later years is to keep in touch with his anger, to retain the right to be angry, to feel its full impact (whether or not it is prudent openly to express it), to recognize the role it plays in his life.⁷

⁶The author has recorded an instance in which a boy of nine was not aware of resentment when his father treated him unkindly but then felt violent anger when he happened to recall this episode many years later.

⁷One of the central tasks when children and adults undergo psychotherapy is to become aware of the nature of their anger and to deal with it thoughtfully

Anger is not, however, the only emotion in connection with which a child can go astray in his development. As we have noted earlier, children have irrational fears. Large numbers of children also acquire other emotional burdens such as feelings of inferiority, irrational feelings of guilt and self-reproach. There is no easy or certain way to remedy these ills, but this does not justify a widespread policy that now prevails in dealing with children's emotional development—a policy consisting mainly of suppression in the culture at large, and a policy, in the school, of ignoring and evading the implications of children's emotional problems.⁸

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rather than blindly. In a study by the writer and his associates (1962), in which over 100 teachers who had undergone therapy gave an account of their experience, one outcome reported most by practically all was greater awareness of or insight into the role of anger in their lives. Many reported they recovered buried resentments going back to childhood years. A large proportion of those who reported this outcome said that it was unexpected, for they had not been aware of their anger as a "problem" before they entered therapy. A large proportion also reported that greater insight into anger and freedom to feel it eventually enabled them to be more spontaneous, forthright, and friendly in their relations with other persons.

⁸ In the writer's opinion, the one who can benefit most from child psychology is the child himself. But to realize this benefit it will be necessary to provide an education which not only helps a child to understand things in the world about him, but also to understand the most important thing—himself.

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CHAPTER 7

Adolescence

Adolescence, the period of transition from childhood to adulthood, brings many changes in a young person's way of life. These changes are due both to developments within the adolescent himself and to demands placed upon him by the culture in which he lives.

Biologically the adolescent ceases to be a child and becomes able to beget children. If all goes well, this is accompanied by a shift from dependence on his elders to the role of having others (his children or surrogate children) dependent on him. It is also accompanied by an ability to give and to receive wholehearted affection in relations with a prospective mate.

In the vocational sphere the adolescent is expected to choose, or to make progress toward choosing, an occupation that will provide economic self-support.

Intellectually, adolescence means a continuing increase in mental ability, as measured by standard tests. This increase, more marked in the early teens, tapers off but still continues in the late teens and, in many instances, through and even beyond the early twenties. In his intellectual development the adolescent also acquires, if all goes well, an increased ability to think in terms of abstract principles and generalizations, an increase in knowledge and practical judgment and an increase in common sense.

During adolescence young persons gain a broadened conception of their identity as separate selves, of their sex role as masculine men and feminine women, and as self-sustaining individuals who have acquired aspirations, values, and moral commitments that will constitute the rudiments of their philosophy of life.

A TIME OF DECISION

Adolescence is a time when most young people have to make decisions (by choice or compulsion or default) that frequently have lasting consequences throughout the rest of their lives: to stay in school or not to stay in school; to take a college preparatory course or some other type of training; to work according to plans that can be

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realized only after a long period of professional preparation or to accept jobs that require less training and bring an immediate economic return.

From a philosophical point of view, adolescence is preeminently a time of choice: a time when the young person can choose what kind of future he will make for himself. This choice is never completely free. It is determined by his genetic endowment and by circumstances in his life over which he has little or no control (such as being born into a family that is well-to-do or poor, exempt from or subject to prejudice). Yet, although his freedom to choose is restricted, the individual adolescent cannot escape the feeling that it is he who chooses and it is he who must live with the consequences of his choice.

TODAY'S ADOLESCENT COMPARED WITH ADOLESCENTS SOME GENERATIONS AGO

Present-day adolescents are in some respects more precocious than they were generations ago. In their physical development girls reach the menarche (first menstruation) at an earlier age than did their grandmothers. The adolescent "growth spurt" comes earlier, and boys and girls are taller, age for age, before, during, and at the end of adolescence than they were some generations earlier (Tanner, 1955).

Adolescents show an earlier interest in the opposite sex than in the 1920's and 1930's. American city girls have their first dates earlier than in the 1920's (W. M. Smith, 1952). The current practice of "going steady" is more widespread and begins earlier than similar relationships some decades ago. Adolescents exhibit an earlier interest in social relations, love, and marriage (Harris, 1957), and more of them marry while still in the teens (Burchinal, 1960).

The evidence as to whether more precocious maturing in the physical and heterosexual sphere is accompanied by a corresponding earlier ability to assume responsibility, and to acquire a mature outlook on life, is inconclusive. Young people in a study by Jones (1960) expressed a more serious purpose than those studied several decades earlier. However, Hetzer (1959), who compared compositions written by adolescents about themselves in the 1950's with corresponding compositions written in the 1920's, reports that adolescents in

1950 lagged behind those in the 1920's in "maturity of self-evaluation."

Another characteristic of the present crop of adolescents is that they participate less in the activities of their elders. This has been brought about in part by the drift of population from the farm to the town, and from the small town to the large city or suburbs, and by the increase in the number of parents whose occupation is outside the home. Most adolescents now receive their training for work outside the home. Coleman (1961) found in a study of students in ten high schools that in most schools less than 25 per cent of the boys wanted to enter their father's occupation, and in four city and suburban schools the proportion fell to 9.8 per cent.

From a study of the populations in ten high schools, Coleman concludes that the present-day adolescent is, to a large extent, cut off from the rest of society, forced inward toward his own age group, and made to carry out his social life with others of his own age. The adolescents whom Coleman studied constitute a subculture, with a language of its own, with special symbols, and with value systems that differ in important respects from the value system of their elders.

PSYCHOLOGICAL REPERCUSSIONS OF PHYSICAL DEVELOPMENT

The physical changes that take place in adolescence are dramatic in their own right and they become even more significant because of their psychological implications. The psychological meanings of these changes are in many respects more important than the changes themselves. One of the adolescent's major tasks is to adapt his "body image"—the view he has of the physical properties of his body—to the changes that occur during puberty.

Two factors especially contribute to an adolescent's subjective evaluation of his physical traits. First, the ideas and attitudes he has formed prior to adolescence are likely to color his perception of his physical characteristics and personal appearance as he moves through adolescence. As a consequence he may not see himself as others see him. A youngster who as a boy was ashamed of his freckles may, for example, regard himself as far less handsome as a young man than others regard him. Secondly, wide individual differences

in the timing, rate, and course of physical growth draw the adolescent's attention to ways in which he compares with others. It is interesting to note some of these differences. The average girl reaches the menarche at about the age of 13 years, but a number of girls reach this stage before the age of 11, and some have not reached it by the end of the 15th year. In a group of boys studied from year to year by Stolz and Stolz (1951) the growth spurt began at an average of about 13, but the range was from 10.4 to 15.75 years. The end of the puberal growth period ranged from 13.10 to 17.5 years.

For a time during adolescence, youngsters differ more widely than they did at an earlier age not only in bodily size but also in bodily proportions. One factor that influences bodily proportions is volume and distribution of layers of fat. Many boys for a time have fat deposits that are not regarded as appropriate for a male, such as in the breast area. Girls differ to a great extent not only in the amount of fatty tissue but also in the extent to which it is concentrated in various areas of the body—breast, abdomen, hips, thighs, and other areas.

Conspicuous individual differences appear in connection with the growth of the genital organ in boys. In a study by Schonfeld and Beebe (1942) of the growth of the penis, which is an important symbol of manliness, it was found that at age 13 boys in the upper 10 per cent had organs twice as long as those in the lowest 10 per cent. The differences in the late teens were not relatively as large but were still substantial (a ratio of about 1.5 to 1 as compared with 2 to 1 in the early teens).

Early and late maturing has many psychological repercussions, especially in boys. As compared with a late-maturing boy, the early-maturing boy, for a time, is relatively bigger, stronger, and more robust than he will be when both have reached their full growth. These characteristics give the early-maturing boy a more masculine appearance than that of late-maturers.

Other things being equal, the early-maturing boy is admired more, both by other boys and by girls, than the one who lags behind in his growth. One reason for this is the great value young people place on prowess in athletics. Boys who are sexually more mature are more likely to be chosen as athletic leaders (Latham, 1951). Early-

maturing boys in a study by Jones and Bayley (1950) were rated as more attractive, less affected, and more relaxed in their behavior. They were rated by other boys as more grown up, more assured, and more likely to have older friends. When these early and late maturers were compared in later adolescence, when the physical differences between them were not relatively as marked as before, there still remained a number of psychological differences. Those who had matured early more often gave evidence of a favorable view of themselves, while more of the late maturers than of the early maturers showed feelings of inadequacy and indications that they had felt rejected by their parents (Mussen and Jones, 1957).

SEXUAL MATURATION AND SEXUAL BEHAVIOR

The culmination of sexual development is reached in adolescence when the young man and woman are able to produce fertile spermatazoa and egg cells. In many girls there is a lag, which may stretch over a period of months or even a few years, between the onset of menstruation and this development.

Adolescents' sexual development goes back to early infancy. As an infant a youngster shows signs of sensitivity in the genital area and most children, unless deterred, experiment to produce sensations in the genital region. The youngster has a continuing interest in sex throughout the childhood period. A majority of boys have had sexual experiences, mainly masturbation, prior to the adolescent years. During adolescence, however, the interest is intensified and sexual desires become more urgent, especially in boys.

It is interesting to note that although girls from an early age are biologically more mature than boys of similar age (as indicated by the development of their bone structure, the onset of changes during puberty, the age of menarche as compared with the corresponding development in boys) boys are far more active and enterprising than girls in the sexual sphere both in their overt behavior and also in their private preoccupations and dreams. According to Kinsey's findings, the typical boy of fifteen has had as wide a range of sex experience as the typical woman has undergone in her middle twenties.

Girls and boys are more alike in the sex play they undertake than in active and direct efforts

to achieve what Kinsey so poetically calls an "outlet." Petting as a means of erotic stimulation is almost universal. Among girls approximately 90 per cent have had the experience at the end of age twenty (Kinsey, Pomeroy and Martin, 1948, 1953). In connection with petting activities, however, boys far more often seek to achieve a sexual climax than girls. In a study of college students by Ehrmann (1952) 39 per cent of the men and 9 per cent of the women when on dates went to the final stage of having intercourse. (The discrepancy is explained mainly by the fact that a large proportion of the boys had dates with girls who were not attending college.)

In their upbringing girls acquire a more mature and responsible attitude than boys with regard to sex activity. In the relations between boys and girls the boy is typically the aggressor, and it is the girl who says no and serves as a conscience for two. In a study of high school boys' and girls' interest in matters relating to marriage and parenthood, the subject of pregnancy stood highest among the girls' interests and had a rank of 11 among the boys (Lantagne, 1958).

MENTAL GROWTH

During the early teens, and in the preceding one or two years, the typical child reaches several landmarks in his mental growth, such as were mentioned briefly early in this chapter. Noteworthy among the adolescent's intellectual characteristics, as compared with earlier years, is his ability to reflect, to retrace steps in his thinking, to think in terms of an abstract theory and to generate theories of his own (Inhelder and Piaget, 1959). Throughout the adolescent years there usually is an increase in mental abilities as measured by standardized tests. (Exceptions to this occur in severely retarded children.) The rate of growth, however, is not as rapid after the age of sixteen as it was before that time.

SUPERIOR AND GIFTED YOUTH

Youngsters with IQ's of 120 or 125 and above are frequently referred to as "superior." They represent from about 5 to 10 per cent of their age group. Within this group youngsters with IQ's of 135 to 140 and above are commonly labelled as "gifted." They represent from about 1 to 3 per cent of the population.

Such young people are an important asset to the society in which they live. It requires an able mind to master fields of knowledge on which an age of science and technology depends. Neel (1960) estimates that less than 10 per cent of individuals in our population are inherently able to make original contributions in fields of science on which our national well-being depends. (This figure can only be regarded as a rough guess, but it underscores the social importance of high intelligence.)

During childhood and youth intellectually gifted persons are, as a group, above average in practically all qualities that are valued in our society, such as academic achievement, bodily size, health, moral judgment, general behavior, and tenacity of purpose. As young adults, and at "mid-life" (age forty or more), most of them continue in their achievements to carry out the promise of their youth (Terman and Oden, 1940, 1959).

Although gifted young people are ingenious in finding ways of making constructive use of their high intelligence they need appropriate nurture and training to achieve their full potential. In 1940 Terman and Oden noted that possession of an IQ above 140 or 150 seemed to add little to a person's achievement during early adult years. They stated that educators apparently have not learned how to bring the highest intellectual gifts to fruition.

Appropriate education is important not only to help the gifted to reach a high level of scholastic and vocational achievement, but also to promote their emotional and social development. A high IQ does not in itself guarantee good emotional adjustment. Available evidence indicates that those with high intelligence are likely to excel more in their objective achievements than in their ability to achieve harmony and contentment in their own personal lives.

A study of a gifted group in "mid-life" (Terman and Oden, 1959) indicated that about one-fourth of the group suffered from "some maladjustment" such as excessive feelings of inadequacy, inferiority, fatigue, mild anxiety neurosis, and the like, or exhibited noticeably odd or freakish behavior. These problems did not seriously interfere with their achievement or their ability to manage the practical affairs of their lives. In addition to those rated as having "some" maladjustment approximately 9 per cent of the total group were rated as having "serious maladjustment."

It is not possible to tell to what extent an education that emphasized not only intellectual achievement but also gave attention to emotional problems and mental health might have benefited the rather large proportion of bright persons suffering from "some" or "serious" maladjustment. However, the findings do suggest that it would be worthwhile to try to provide an education that might help these individuals, while still in school, to understand themselves and to cope with their personal problems. Kubie (1954) has noted that brilliant scholars may apply their intellects to evade rather than to face issues in their personal lives.

A difficulty some bright youngsters meet is that instead of being admired by others they are deplored by others because of their brightness. In most high schools, students are likely to admire the student who is a good athlete more than the bright scholar, unless the bright scholar happens also to be a good athlete (Tannenbaum, 1962). A bright student may be disliked for setting a high standard of achievement in the school, especially if his classmates are forced to work harder to keep up with him.

In a large-scale study of high school students, Coleman (1961) found that it was the best athletes and not the best scholars among the boys who had the most positive feelings about themselves. Coleman also found that the girls who were most popular with boys had the most positive feelings about themselves. Many of the brightest girls shrank away from the "brilliant student" image and managed to hide their intelligence.

In spite of his great assets it is not easy for a bright adolescent fully to appreciate his own worth and to acquire an accepting attitude toward others, if he is disliked by less able students for being bright. (If he is transferred to a homogeneous group where all youngsters are bright he may still find it hard to feel a healthy pride in his brightness because he and his teachers now use other bright peers as a measuring rod.)

THE BRIGHT "UNDER-ACHIEVER"

Many above average and bright youngsters are regarded as "under-achievers" by their teachers because their academic work is poorer than might be expected from their scores on intelligence tests. Under-achievement has been attributed to many conditions, such as lack of proper encouragement

in the home, hostile attitudes toward authority, and other non-intellectual factors. Studies of under-achievers do not reveal any one outstanding factor that accounts for their condition (Ralph and Tannenbaum, 1961).

Some investigators have pointed out that a so-called under-achiever actually may not be under-achieving. A good intelligence test score is not in itself a guarantee of competence in individual academic subjects. A youngster may be bright and still be very uneven in his abilities. The fact that he is bright does not necessarily mean, for example, that it would be easier for him to learn a foreign language than one who is considerably less bright (Goldberg, 1962). Goldberg points out that intelligence test scores account for "only a modest portion" of individual differences in abilities in mathematics. In view of this a so-called under-achiever may fail to live up to expectations not because of any flaw in him, but because too much is expected of him.

CHANGING SOCIAL RELATIONSHIPS

One of the adolescent's major tasks is to outgrow childhood dependence on his parents and to establish a place for himself in the society of his peers.

EMANCIPATION FROM PARENTS

Adolescents' efforts to become independent of their parents range from quiet attempts to assume self-direction to acts of stormy rebellion. Even in the most serene family there will be times of stress. An adolescent's striving for independence requires a radical departure from the relations he had with them when he began life as a helpless child. Parents must also renounce many deeply-rooted ways of dealing with their offspring.

An adolescent's efforts and successes in striving for independence are likely to be uneven. Most youngsters, while insisting on managing some of their own affairs are unable to manage others. Most of them are still financially dependent on their parents. Almost inevitably, they will demand adult privileges before they have acquired a corresponding sense of responsibility.

From the point of view of adolescents, parents often seem unreasonable, demanding, and needlessly worried. But worried parents can readily find evidence to justify their worries. They have

a real reason for concern when they note the automobile accident rate among adolescents (according to a Gallup poll in 1961, 50 per cent of boys have been in automobile accidents as drivers by the time they reach senior college age, and an additional number have been in accidents while riding as passengers). Parents also feel concern about their youngster when they note the high incidence of premarital pregnancy, delinquency, rowdiness, vandalism, and drunkenness right within their own community. Most young people, fortunately, negotiate the adolescent period without serious or lasting damage, but there are many hazards along the way.

The typical adolescent has many complaints about his parents. A large proportion of these arise in connection with the adolescent's desire no longer to be treated as a child and his efforts to appear and act grown up. In one survey (Block, 1937) 60 per cent or more in an adolescent group expressed annoyance about details such as being pestered about their table manners; having a brother or sister held up as a model; being questioned about school marks; restrictions on use of the automobile, or going for rides in someone else's automobile; being called on to give an account of how money was spent. Many conflicts between parents and adolescent girls center around dating and choice of boy friends (Connor, 1954).

Difficulties in the home become especially acute when the parents counter an adolescent's complaints against them with complaints against him, or if parents feel unequal to their task. Many parents, as we have noted, are apprehensive about the adolescent's safety and well-being. Parents also frequently feel rejected and are, in effect, rejected when a youngster refuses their advice and, instead, takes his advice from his peers; when he refuses to take part in family outings and celebrations that once were so important to him as a child; when he criticizes them for weaknesses he previously had not noticed. Such actions may be a constructive part of the young person's endeavor to become independent, but it is not easy for parents to view these actions objectively.

Many parents also have a feeling of failure, especially when adolescent children get into scrapes or are emotionally distressed. Any real or imagined failure is likely to lead to anxiety and feelings of guilt. Parents also frequently have a feeling of helplessness in the face of a concerted

effort by the adolescent peer group to have its own way. It is difficult for an individual parent to stand up against the pressure and resistance of a whole army of adolescents.

The adolescent struggle for independence continues in a large proportion of young people through high school and into college-age years. Many young people of college age remain emotionally dependent on their parents even when they have achieved a considerable amount of independence in the management of their practical affairs. Many have not achieved what Lloyd (1952) has called "emotional emancipation."

Actually it probably is a rare adolescent or adult who achieves complete emancipation from his parents in the sense that he does a thorough job of thinking through for himself the attitudes, viewpoints, and moral values which he has learned to take for granted in the course of his upbringing. Even when a young person takes a stand quite different from that of his parents (in connection with politics, religion, standards of conduct) he is still under the domination of his parents if he consciously or unconsciously takes this stand to defy his parents or to prove that they have no influence on him.

An interesting and, from the parents' point of view, gratifying sequel to the struggle for independence occurs when sons or daughters in their twenties or thereafter adopt parental ideas and values which they had rebelled against during their struggle for independence. Mark Twain has described such a change: "When I was a boy of fourteen my father was so stupid I could scarcely stand to have the old man around, but by the time I got to be twenty-one I was astonished at how much he had learned in the last seven years." Quite often, likewise, adolescents who were adamant in resisting the wishes and advice of their parents will, at a later time, look back on this period and openly wonder how their parents were able to put up with them.

THE ADOLESCENT PEER GROUP

The adolescent peer group wields a powerful influence on its individual members. The typical adolescent conforms to the group in large areas of his thinking and behavior. A strong impulse to conform continues through the teenage years and into the early twenties, even when young persons are exposed to experiences that might

produce diversity rather than conformity. In most colleges it appears that seniors are, if anything, more conforming in their attitudes and ideas than they were as freshmen (Jacob, 1957).

The adolescent population does not, however, operate as a single monolithic force. There are subgroups or subcultures, each demanding its own particular brand of conformity. The standards and values in a so-called "delinquency area" differ in important respects from those in a non-delinquency area.

Miller (1958) has described characteristics of a "gang-delinquency" subculture, with long-established and distinctively patterned traditions of its own. In this lower class culture, according to Miller, there is a considerable concern about trouble as related to law abiding and non-law abiding behavior, and in some situations getting into trouble is a source of prestige. There is also a strong concern about toughness—the tough-guy model. Another "focal concern" is smartness in being able to out-think, out-fox others and in being able to avoid being duped oneself. Yet another concern is search for excitement and thrills such as can be gained by gambling or the use of alcohol. A fifth concern is with fate, embodying the idea that a person's life is governed by fortune or luck rather than by conditions which he can control. Also in this culture, according to Miller, many individuals do not desire to be self-directing or autonomous but, instead subject themselves to a considerable amount of external control even while resenting such control.

There are differences also in the standards and expectations that prevail in lower as compared with higher socioeconomic levels. At the lower levels, as compared with the higher, there is less expectation that young people will finish high school or go on to college. There is relatively more emphasis on getting a secure job than on getting into a venturesome occupation. There is more emphasis on working for immediate goals and for immediate gratification than on working for deferred goals that require a long period of preparation. In the lower socioeconomic groups there is also relatively more tolerance of aggression directed against peers but not necessarily of aggression directed against parents.

Although differences such as the foregoing can be observed in the lower and higher socioeconomic groups, individual adolescents differ in the extent

to which they conform to or depart from the prevailing pattern. Young people of lower status who are "upward mobile" manage to resist the values of their group and to adopt values that prevail at a higher social level. Kinsey noted, for example, that there were differences in the sex practices of lower and higher socioeconomic levels (relatively more premarital heterosexual activity in the lower group and relatively more masturbation in the higher group), but boys in the lower group who were heading toward a higher group tended to adopt the standards of the group toward which they were moving rather than the standards of the group into which they were born.

A youngster of lower status who is "upward mobile" must almost of necessity also adopt a policy of deferred gratification, even though this is not the prevailing policy in his own group.

Relatively little is known about the factors which are responsible when one youngster in a "delinquency area" becomes delinquent and another does not, or when a young person of lower status is heading upward, or when a person of higher status is heading downward in the socioeconomic scale. Frequently one can observe that the parents of a "lower" youngster who is heading upward are not content with their occupational or educational status and are encouraging their children to set their sights on a higher level. But this still leaves unanswered the question as to why some parents adopt this attitude (and are able to communicate it to their children) while others do not.

ACTIVITIES AND ATTITUDES RELATED TO COURTSHIP

Adolescents' interest in the opposite sex occupies a large portion of their activity and oftentimes an even larger portion of their fantasies. Their relations with the opposite sex in their fantasies are likely to be more romantic, intimate, and daring than in their actual behavior. This is especially true when young persons, in imagination, worship a "dream girl" or a "dream boy" who is more wonderful than anyone they meet in real life. The dream is confused with reality when young persons fall in love and endow the loved one with all the glorious qualities of the girl or boy of their dreams. Young persons are, in effect, falling in love with ideal but unrealized versions of themselves when they see the loved one as the fulfill-

ment of aspirations and yearnings that are unfulfilled in their own lives.

Although young persons are able to describe at least some of the qualities they desire in an ideal mate (Mather, 1934) the adjectives they use are likely to give only a sketchy reflection of the image they have in their own minds. Relatively little is known about how adolescents' images of an ideal mate come into being; how dim or vivid the image might be in one person compared with another; to what extent it approaches or differs from reality; to what extent it is realized, or has been modified or perhaps discarded, when young people become engaged and later are married.

Adolescents usually have many experiences that might help them to test their thoughts and feelings about the opposite sex. Most of them have dates; many "go steady" with a succession of "steadies." The typical girl or young woman has fallen in and out of love several times before marriage (Landis *et al.*, 1940; Ellis, 1949a, 1949b). Presumably the same would hold true for boys if a corresponding study were made of them.

In many respects girls of courting age have a more difficult time than boys. Boys have more freedom to roam. They are supposed to take the initiative. The responsibility for premarital pregnancy rests far more heavily on the girl than in the boy. Many girls have unpleasant experiences relating to sex. In a study by Jameson (1941) 21 per cent of a group of girls, juniors in college, reported that they had had shockingly undesirable experiences with boys during the college years. Three-fifths of a group of married women in a study by Landis *et al.* (1940) and half the members of a group of unmarried women reported that they had been the object of aggressive sexual advances by boys or men before they reached puberty.

Although girls learn from warnings by others or from their own experiences to be on guard against males they are also under heavy pressure to be attractive to males. According to their own accounts, it is considerably more important for girls to be popular with boys than for boys to be popular with girls. Popularity with the opposite sex has more influence on girls' than on boys' evaluation of themselves (Coleman, 1961).

In a study by Jameson, cited above, a large proportion of college girls reported "unhappy states of mind" due to inability to be popular with men;

the percentage was higher at the junior college level (66.4) than at the freshman level (29.5).

In their desire to be attractively feminine and to guard against bruising masculine vanity, girls frequently underplay their abilities or pretend to be inferior. This happens when bright high school girls deliberately do not earn the highest marks (Coleman, 1961). It also happens when a girl on a date "plays dumb," allowing the man to feel superior (Komarovsky, 1946). Wallin (1950) found that a large percentage of college girls (40 per cent or more) once or many times had pretended, when with men, to be inferior in knowledge or in athletic ability or in other ways.

EARLY MARRIAGE

During the past half-century the age of first marriage has declined. According to census data cited by Glick and Landau (1950), the average estimated age of first marriage for men dropped from 26.1 years in 1890 to 22.7 years in 1949; the corresponding figures for women were 22 and 20.3. Considerably more girls than boys marry while still of high school age, and a large proportion of the girls who marry voluntarily drop out of school or are expelled. Many of the girls who marry at high school age are premaritally pregnant (about 40 per cent in a sampling studied by Burchinal, 1959). Girls in this group dated at an earlier average age than unmarried girls in the same communities; they had their first "steady" at an earlier age; they had more steadies and said they had been in love with more steadies than girls in the unmarried group.

FINDING THE SELF

The ideas and attitudes young persons already have formed regarding themselves influence and are influenced by all that occurs during the adolescent period of growth. In an earlier section we noted the interplay between physical development and adolescents' views of themselves.

The adolescent's ideas about who and what he is influence his vocational interests and plans, and when he finally chooses an occupation, he has made a commitment about what he might become. If the young person's struggle for independence has been moderately successful he can regard him-

self more than ever before as one who can manage his own affairs.

As a young person moves through middle and late adolescence into adult life he becomes increasingly aware of the distinction between what—for him—is possible and what is probable. Some adolescents with modest expectations discover that they have underestimated their resources. Others find that their earlier dreams of glory reach far beyond anything they will realize. At the end of the adolescent period a person's self incorporates everything that is embraced in his awareness of his existence as a young adult.

Several self-description tests or inventories have been devised to get information about how a person views himself, how he views others, and how others view him. These are usually built on a list of adjectives—such as generous, cheerful, industrious—incorporated into a statement (such as "I am generous"), with modifiers such as "always," "sometimes," "never." By varying the form of the statement it is possible to get information concerning his view of his "actual" self ("I am ———"); his "ideal" self ("I wish I were"; "I would like to be"); his view of others in general ("Most people are"); his view of other particular individuals, such as the members of his class ("Henry is," "Helen is"); his view of how he thinks others regard him ("Henry thinks I am"); and the view others have of him, as shown by a compilation of how others rate him.

Self-description inventories tell a great deal about what an adolescent thinks he is or ought to be. (They also leave much untold, as will be noted shortly.) If he has responded candidly, assessing himself as truthfully and conscientiously as he can, the appraisal he makes represents facets of his real self as he sees it, whether or not it corresponds to the way others see him.

Self-other comparisons yield a number of interesting findings. One finding is that an adolescent who gives a preponderantly favorable or unfavorable account of himself is likely to give similarly preponderantly favorable or unfavorable account of others. A person tends to judge others as he judges himself, and we can infer a great deal about a person's attitudes regarding himself from the kind of judgment he passes on others.

It has also been found that adolescents who do not get along well with their peers are less realis-

tic in their self-descriptions (as judged by others) than those who are socially well-adjusted (Goslin, 1962). It is not possible to tell from this whether the person is disapproved because he is unrealistic or is unrealistic because he is disapproved, but it seems that a person who denies his foibles and pretends they don't exist is more likely to be regarded as an unpleasant phony than one who is more forthright about himself.

In another self-other comparison, Hess and Goldblatt (1957) found that adolescents believed their elders would rate them less favorably than they actually did. They also found that parents assumed adolescents had unrealistically high opinions of themselves, but the young people's self-ratings did not bear this out.

KNOWN AND UNKNOWN DIMENSIONS

The ideas an adolescent has about himself represent his *known* self. The extent to which these ideas are realistic depends on his insight. He possesses insight if he can correctly recognize and acknowledge his assets and limitations, correctly interpret his present motives and assess the ways his past experience has molded his present outlook on life. He lacks insight if he is swayed by unrecognized (unconscious) motives different from those he regards as his actual motives. Such lack of insight exists when an adolescent, for example, has a chip on his shoulder but has no awareness of this, perceiving himself, instead, as one who prudently guards his own rights.

An adolescent who is wise to himself is spared many hurts. He is free to do the right things for the right reason. He does not have illusions which he must labor to keep alive. He can take a thoughtful view of compulsions by which adolescents often are blindly driven, such as compulsion to compete, to be popular, to conform.

Insight is especially valuable, and lack of insight burdensome, in an adolescent's attempts to cope with anxiety that arises because of conflicts within himself. All adolescents suffer from such anxiety to some degree, for all of them have conflicting impulses. They have an impulse to be angry that collides with fear of rejection or retaliation; an impulse to be loyal to parents and also an impulse to rebel; an impulse to yield to others by conforming to group pressures and also a desire to assert their individuality; a desire for

popularity and a recoil against paying the price; and sexual desires that clash with their moral scruples. Such conflicts create uneasiness even when a young person deliberately, with full knowledge of what he is doing and what the consequences may be, acts on one motive and resists the other.

The situation is more disturbing, however, when, in an effort to escape from conflict, he renounces one course of action and adopts the other as though it were his "true" self. He may, for example, adopt a policy of placating everyone and regard this as an admirable character trait, seeing himself not as an appeaser but as a generous and reasonable person. In like manner, he may rationalize his choice of other alternatives. If he is unscrupulous in his sex behavior he may not see himself as promiscuous but as "emancipated" from stupid moral conventions. If he adopts prudish attitudes as a defense against sex he may not see himself as a frightened prude but as one who has noble moral convictions. Instead of seeing such rationalizations as a protection against inner conflict he sees them as a sign of strength. But his view is precarious. The one who meekly placates others as though to do so were a virtue will now and then feel a passionate urge to assert himself; the one who views his sexual freedom as evidence of emancipation will have twinges of conscience, and the one who protects himself by being a prude will feel a surge of desire that threatens to shatter his pose. All such surges from within are a threat to the stance a person has taken. Any threat of this kind produces anxiety.

PERSISTENCE AND CHANGE IN CHILDHOOD PERSONALITY TRAITS

Personality traits which a youngster showed conspicuously as a young child are more likely to persist than to show a marked change as he moves into adolescence and early adulthood. A shy child is likely to become a shy adult (Morris *et al.*, 1954). A boy who asserts his wishes aggressively as a baby is likely to be aggressive as an adult.

However, as youngsters grow older there are changes in the way in which they manifest some of their characteristics. There is likely, for exam-

ple, to be a shift from rather crude to more subtle aggressiveness and, as a consequence, a seeming loss of aggressiveness.

A child's upbringing and influences in his total environment encourage some traits more than others, and some of these influences operate differently in the case of boys than in the case of girls. Aggressiveness in boys is tolerated and even encouraged to a greater extent than aggressiveness in girls. A tendency to be dependent on others is usually tolerated more in girls than in boys. As a result a certain childhood trait may show a high degree of persistence in one sex but may be altered or concealed in the other sex.

Moreover, during the course of growth youngsters also acquire varying ways of "living with" a particular trait. A conspicuously shy youngster may, for instance, as an adolescent and adult, seek a secure and sheltered rather than a highly competitive way of life.

Among the traits that have been found in various studies to show a significant degree of stability through childhood and into adolescence or beyond are: shyness and aggressiveness in boys;¹ a striving by girls for social recognition; passive tendencies (leading, in boys, to a tendency to avoid rugged sports or dangerous activities during pre-adolescent years); competitiveness in both sexes; and strong (preadolescent) strivings for achievement.

Some traits that appear in childhood but do not persist in the same form into later years may be followed in later years by other traits that belong to the same genus. For example, a boy who is passive as a young child may be non-competitive and show non-masculine interests in later years (Kagan and Moss, 1962).

To assess the extent to which childhood characteristics persist into later years it would be necessary not only to take account of overt manifestations but of covert tendencies which are difficult to measure. As a child and as an adult a person may, for example, seem quiet and gentle and seldom if ever display anger openly, and yet have a persisting tendency to feel aggrieved and abused.

The possibility that a characteristic which has

¹ Among the studies dealing with this topic are Neilson (1948); Tuddenham (1959); Morris *et al.* (1954); Kagan and Moss (1962); and Gesell and Thompson (1941).

not been stable in its manifest form may still persist in a covert form is especially significant in connection with characteristics which seemingly change because they are not regarded as feminine in women or masculine in men. When a girl, for example, who had a strong impulse as a child to retaliate never resorts to unladylike retaliation as an adult, she seems to have undergone a personality change. But a more penetrating inquiry might reveal that she now has a great deal of concealed aggressiveness.

The fact that some traits show a high degree of tenacity is important not only for understanding others but for understanding oneself. An adolescent's or an adult's personality is the product of hereditary and environmental forces which have operated for a long time. To redo it or remake it is extremely difficult if not impossible.

In a study by the author and his associates (1962), persons who had undergone intensive psychotherapy (most of them for three or four years or more) claimed that some change or a great change had taken place in many aspects of their lives. However, this did not mean that they had acquired a new or substantially modified personality. It meant, rather, that they had deeper awareness and more insight into their motives and characteristic ways of behaving and were, according to their reports, better able to live with themselves. A large proportion claimed, for example, that they were better able to understand and to manage their competitive tendencies. This did not, however, mean that they had been converted from competitive to non-competitive persons. It meant, rather, that they competed more knowingly, were more aware of competitiveness in others (such as often is expressed in an ordinary conversation) and, instead of being driven they were able either to choose to compete or when, where, and with whom to compete. Large proportions claimed that they had benefitted in connection with dealing with their tendencies to be anxious, aggressive, or compliant; but this did not mean that they no longer were susceptible to anxiety, or that the compliant person had been converted into an aggressive person.

In the course of life's experiences all people change somewhat, and some people change their way of life quite radically. But even where radical change occurs, certain basic traits, although ex-

pressed differently or directed into different channels, are likely to remain essentially the same.

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CHAPTER 8

Differential Psychology: Individual Differences

Differential psychology is concerned with behavioral differences among individuals and among groups. Its fundamental aim is similar to that of all psychology, namely, the understanding of behavior. Differential psychology approaches this problem through a comparative analysis of behavior under varying environmental and biological conditions. By relating the observed differences in behavior to other known concomitant circumstances, it may be possible to tease out the relative contributions of different factors to behavioral development. If we can determine why one person acts differently from another, we shall know what makes people react as they do.

SCOPE OF DIFFERENTIAL PSYCHOLOGY

Individual variation occurs throughout the animal scale. Superficial and inadequate observation often creates an impression of similarity and even identity among the members of a group while the differences pass unnoticed. "All cats look gray at night" but upon closer inspection each emerges as an individual in his own right. Although most experimental psychologists have traditionally ignored individual differences, an examination of the data themselves never fails to reveal such differences. Whenever more than one subject has been observed, the fact of individual variation has been substantiated.

From protozoon to man, no two individuals react alike when presented with the same objective situation. Conditioning experiments have shown wide individual differences among members of any single species in the number of trials required to establish a conditioned reaction. Equally wide differences have been found in maze learning, problem solving, timidity, aggressiveness, strength of various drives, and other aspects of behavior (see Anastasi, 1958, pp. 48-53). In an experiment on paramecia, for instance, individual differences were noted in the rate of learning to escape from a tube, some animals failing to learn at all while others learned in a few trials (French, 1940). Of particular relevance is an early series of studies in which such dissimilar species as guinea pigs,

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rats, cats, and monkeys were tested with the same type of problem box, providing steps of increasing difficulty (see Anastasi, 1958, pp. 50-52; Fjeld, 1934, p. 528; Koch, 1935, pp. 186, 208). Although large differences in learning ability were found between species, the ranges of individual differences within each species were so wide that the number of trials required to learn the first step overlapped among all groups tested. For example, some guinea pigs and rats learned this step in fewer trials than did some monkeys, although *as a group* monkeys far excelled guinea pigs and rats.

Within the human species, individual differences have long been recognized. Many of our basic social institutions, and in fact the patterns of societies themselves, derive largely from the fact that individuals differ from each other. In our everyday activities, we constantly adjust our behavior to individual differences among our associates. Certain broad biological or cultural groupings, such as those based on age, sex, race, or nationality, also play an important part in social interaction. Such group distinctions have frequently determined social institutions and attitudes, to the almost complete exclusion of any consideration of individuals. It is a further aim of differential psychology to inquire into the nature and origin of behavioral differences among these major groups.

HEREDITY AND ENVIRONMENT

BASIC CONCEPTS

The causes of individual variation are to be found in the individual's heredity and in the environmental conditions to which he has been exposed. Every trait or reaction of the individual depends both on his heredity and on his environment. Traits and activities cannot be classified into those that are inherited and those that are acquired. We can, however, inquire into the relative contribution of hereditary and environmental factors to individual differences in any given trait. In some traits, such as eye color, individual differences are largely fixed by heredity; in others, such as the language one speaks, environment plays the predominant part.

The proportional contribution of hereditary and environmental factors to the variance of any par-

ticular trait also depends upon the population under investigation. In a population in which hereditary differences are reduced, as in some of the highly inbred animal strains used in the experimental laboratory, individual differences can be attributed primarily to environmental factors. In a population reared under highly uniform environmental conditions, which again could be achieved with laboratory animals, individual differences result largely from heredity. Although these extreme conditions are not found among human populations, different estimates of the proportional contribution of heredity and environment to the variance of a given trait may be obtained by choosing populations that differ in their degree of hereditary or environmental heterogeneity. Consequently no generalized estimate of the relative contribution of heredity and environment to individual differences in a psychological trait can be stated for all populations.

From both a theoretical and a practical point of view, an important question pertains to the way in which specific hereditary and environmental factors affect behavior. It is not enough to know that both heredity and environment contribute to the development of all traits, nor to know the relative contribution of the two sets of factors in a given population. Particularly if we wish to direct or modify behavior development, we need to know *how* heredity and environment interact in such development (see Anastasi, 1958b).

Our understanding of the mechanism of heredity has been greatly advanced by the concept of the *gene*.¹ The individual organism begins life at conception with the union of one sex cell from each parent, the ovum of the female and the spermatozoon of the male. Each of these cells contains tens of thousands of discrete units, called genes. The individual's heredity consists of the sum total of the genes he receives from his parents. Although each gene is transmitted as a unit (i.e., in an all-or-none fashion), most human traits depend upon the combination of many genes. Even such a relatively simple trait as height depends

¹ It is beyond the scope of this book to provide a detailed account of the operation of heredity. For fuller explanations, the reader is urged to consult such sources as Dobzhansky (1962), Fuller and Thompson (1960), Scheinfeld (1965), and Snyder and David (1957).

upon the combined influence of a large number of genes. This complex hereditary determination will produce varying degrees of a trait, even though the individual genes are transmitted as units. Thus we do not find only "tall" and "short" people, but a whole continuum of varying heights.

There are a few hereditary disorders that are traceable to some chemical defect in a single gene. Examples include albinism, hemophilia, total color blindness, and certain rare forms of mental deficiency resulting from severe metabolic disorders (e.g., phenylketonuria). Among normal traits that are inherited in a simple manner, blood types are probably the most familiar. The vast majority of observable human traits, however, have a complex genetic basis, that is, they involve the joint action of many genes.

The hereditary basis of individual differences is to be found in the almost unlimited variety of possible gene combinations, especially in the case of such a complex organism as man. It is not surprising that duplicate individuals are not produced by chance, when we consider, first, the extremely large number of genes; secondly, the different assortments of genes occurring in the different sex cells of a single parent; and thirdly, the union of sex cells from two parents in the production of any one individual. The only exception to this individual diversity of gene constellation is that of *identical twins*, who develop from the union of a single ovum and spermatozoon. Such twins are always of the same sex and identical in appearance. *Fraternal twins*, on the other hand, do not reveal such close resemblance and may be either of the same or opposite sex. The hereditary similarity of fraternal twins is no greater than that of ordinary siblings,² since they result from the simultaneous development of two fertilized ova.

In popular thinking, heredity is often believed to imply parental resemblance and vice versa. Both sides of this proposition can be shown to be false. That heredity need not result in the resemblance of offspring to immediate forebears is apparent from a consideration of the mechanism of heredity. Thus two normal parents, each of whom carries a single recessive gene for albinism, may have an albino child. In this instance, heredity accounts for the *difference* between the developed

characteristics of parents and child. Through the same mechanism, two brown-eyed parents may have a blue-eyed child. The traits of parents and children may likewise differ because of differences in the combinations of genes that interact in the development of most traits. The converse proposition, that parent-child resemblance is necessarily indicative of heredity, is equally untenable. Such resemblances may develop through the many environmental contacts and similarities of parent and child, both prenatally (in relation to the mother) and postnatally. No parent-child likeness in a psychological trait can be attributed to hereditary factors without further analysis of the development of that trait.

The concept of *environment* itself requires some clarification. The popular definition of environment is a geographical or residential one. A child is said to have a "poor environment," for example, because he lives in the slums. Or his "environment" may be described as a French village, an American small town, or a British mining community. To the psychologist, this is a very inadequate designation of environment. Psychologically, environment is to be regarded as the sum total of the *stimulation* that the individual receives from conception until death. It will be noted that this is an active concept of environment. The mere physical presence of objects does not constitute environment unless the objects serve as stimuli in the experience of the individual. The definition is also a more inclusive one, covering all forms of stimulation and extending over the entire life cycle.

Environment may influence behavior in either of two ways, namely, (1) by producing organic effects that may in turn affect subsequent behavior; and (2) by providing stimuli for psychological reactions. These two types of environmental influence are designated as organic and experiential, respectively. Child-rearing practices as well as formal schooling are examples of experiential influences of environment upon the developing individual. Organic influences of an environmental origin may be illustrated by infections, radiation energy, asphyxia, nutritional deficiencies, and other prenatal conditions causing fetal brain damage that subsequently results in mental deficiency (MacMahon & Sowa, 1959). While not hereditary, such mental deficiency has an organic rather than an experiential basis. To

² "Sibling" is a general term employed to cover both brothers and sisters.

the psychologist, the distinction between organic and experiential causation is fully as important as that between hereditary and environmental causation.

SELECTIVE BREEDING

Since the famous experiments of Mendel, geneticists have made constant use of selective breeding to investigate the inheritance of physical characteristics. The application of this technique to the study of behavior, however, has only recently begun on a limited scale. A pioneer investigation of this type was conducted by Tryon (1940). An initial group of 142 rats were given nineteen trials in running a maze, the number of "errors" (that is, entrances into blind alleys) being determined for each animal. On the basis of the total error scores, ranging from 7 to 214, the rats were separated into a "bright" and a "dull" group. Mating occurred only within each of these two groups. This procedure was followed through twenty-two successive generations, the "brightest" rats in each generation being selected in terms of maze performance and bred together, and the "dullest" being similarly selected and inbred.

The maze-learning distributions of the bright and dull groups gradually separated until there was virtually no overlapping between them in the seventh generation, as shown in Figure 8-1.³ Little or no further differentiation occurred beyond this generation. When groups of bright and dull rats were cross-bred for two generations, distributions similar to that of the original parental group resulted, most of the animals now obtaining intermediate scores, with relatively few at the dull and bright extremes.

These findings suggest that a relatively large number of genes influence maze performance in rats. Through what specific mechanisms these hereditary influences operate, however, cannot be established from such results. Several later investigations have compared the descendants of Tryon's two strains in many psychological and physiological measures (Fuller & Thompson, 1960). The two strains cannot be said to differ in general learning capacity, since the maze-bright

³ In this graph, error scores were rescaled in order to reduce spread at the dull end and to obtain an approximately symmetrical distribution. The actual number of errors falling within each scaled class interval is shown on the graph.

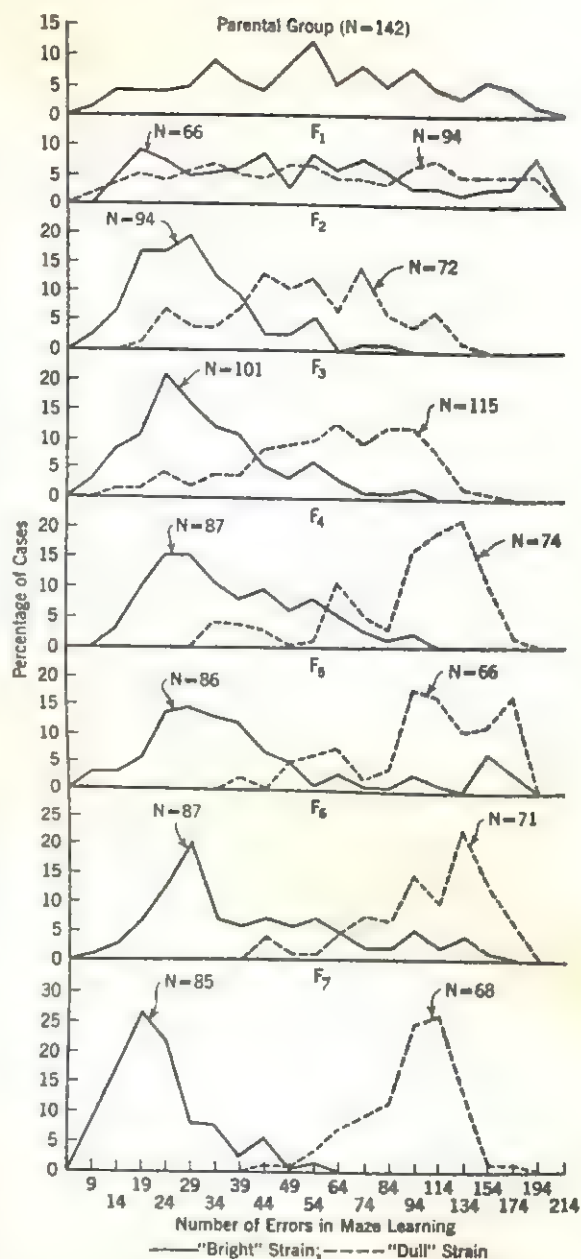


Fig. 8-1 Effect of selective breeding for maze performance. (From Tryon, 1940, p. 113.)

did not excel the maze-dull in certain other learning problems (Searle, 1949). On the other hand, significant emotional and motivational differences were found between the two strains. In this connection, mention might be made of a provocative hypothesis suggesting that in all organisms heredity may influence the development of intellectual skills chiefly through the strength of certain drives,

which in turn determine the nature of the experiences the individual undergoes (Hayes, 1962). Among the most promising physiological variables found to differentiate maze-bright from maze-dull rats are certain biochemical differences that affect brain action (Fuller & Thompson, 1960; Rosenzweig, Krech & Bennett, 1960).

More recent selective breeding investigations have not only repeated Tryon's experiment with more refined research techniques but have also applied these procedures to other behavior functions and other types of organisms (see Anastasi, 1958; Fuller & Thompson, 1960). A highly significant development in behavior genetics is to be found in the research conducted by Hirsch and his associates (Hirsch, 1959; Hirsch, 1962; Hirsch & Tryon, 1956). These investigators worked out techniques for obtaining reliable measures of individual differences in behavior among such organisms as the fruit fly *Drosophila*. It thus became possible to capitalize on the mass of available genetic data regarding the morphology of *Drosophila*, as well as on such other advantages

as the brief time span between generations and the abundance of progeny. Through the use of the newly developed procedures, strains of fruit flies have been produced that are positively or negatively geotactic, respectively, as well as others that are positively or negatively phototactic. In the former case, one strain tends to fly upward, the other downward, when released in a vertical maze. In the latter, one tends to fly toward a source of light, the other away from it.

The ingenious procedure devised for measuring behavioral differences in the fruit fly is illustrated in Fig. 8-2. In this vertical maze, the flies proceed from left to right, attracted by food and light on the right. When all flies have traversed the maze, those who flew upward at each of the ten choice points will have collected in the top test tube. This group has a score of 10 points in negative geotaxis. Those who have flown upward at nine of the ten choice points will be found in the next test tube, and so on down to the lowest test tube, containing flies that flew downward at every choice point and thus earned a score of zero.

INVESTIGATION OF EXPERIENTIAL FACTORS

A common misconception regarding the operation of heredity and environment is that hereditary conditions are not modifiable by environmental manipulation and, in contrast, that all environmentally produced conditions can be readily altered through subsequent environmental control. This fallacy stems from a failure to recognize that hereditary and environmental factors interact in the development of the organism. Although phenylketonuria, with its resulting mental deficiency, is caused by a defective gene, both the physical and mental disorders associated with it can be prevented by dietary control begun early in infancy. On the other hand, severe brain damage resulting from some abnormality in the prenatal environment may produce irremediable mental defect. Whether or not a condition yields to subsequent environmental treatment depends, not upon its ultimate origin in heredity or environment, but upon the nature and severity of the damage, the stage at which treatment is initiated, and existing knowledge regarding its causal mechanism.

From another angle, we may inquire to what extent behavior depends upon organic factors (of

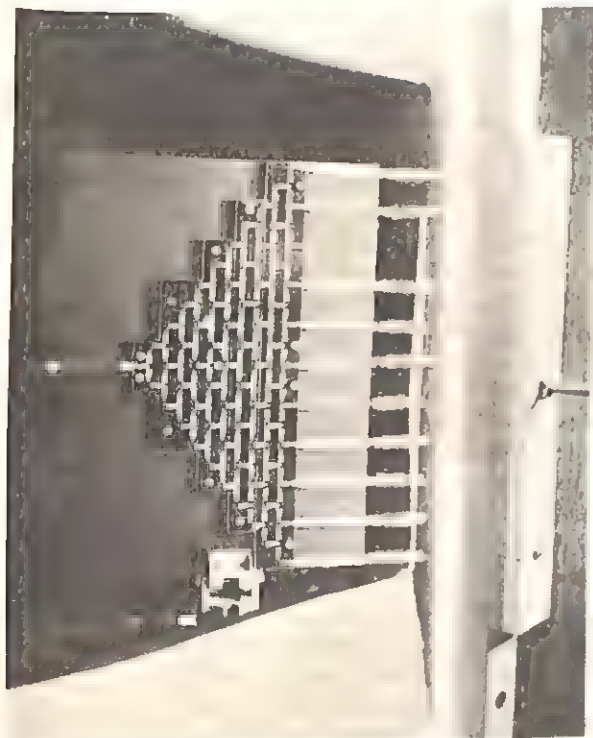


Fig. 8-2 Vertical maze employed in measuring geotaxis in the fruit fly for selective breeding experiments. (From Hirsch, 1959, p. 305.)

either hereditary or environmental origin) and to what extent it depends upon experiential factors. It is this question that is of primary interest to the psychologist. The investigation of the effects of experience upon behavior—or learning in its broadest sense—constitutes a major area of psychological research.

A large number of experiments have dealt with the *effects of early experience upon the subsequent behavior of animals* (see Anastasi, 1958, Ch. 4; Beach & Jaynes, 1954; King, 1958). A wide variety of activities have been investigated, ranging from the swimming of tadpoles and the singing of birds to sexual behavior and care of the young. Many experiments have utilized artificial devices to reduce or cut off sensory stimulation or to eliminate opportunity for the exercise of specific motor functions, in order to discover how far a function will develop in the absence of appropriate experience. Others have followed the opposite approach, providing intensive controlled training in various activities. Significant effects of such prior experiences have been reported for nearly all aspects of behavior, including perceptual, motor, learning, emotional, and social reactions.

Through such experiments, many activities formerly regarded as completely unlearned or "instinctive" have been found to depend upon the animal's prior experience. Even when the animal has no opportunity to practice the specific activity in question, his behavior may be influenced by the exercise of other, related activities. For example, some investigators found that, even when reared in isolation, female rats build nests and care for their young in the typical manner of their species. More highly controlled investigations, however, indicated that the rat's previous experience in manipulating materials and in washing and grooming her own body is necessary for the subsequent appearance of such maternal behavior (Birch, 1956; Riess, 1954). Thus female rats reared in cages containing nothing that could be picked up or transported failed to construct nests when materials were made available. Nor did they gather their young into a single area in the customary way. Another group of female rats was fitted with rubber collars which prevented contact of nose or mouth with the lower part of the body. These collars were worn from infancy to sexual maturity. After giving birth, these rats failed to clean or groom their young.

Of particular interest to differential psychology is a group of experiments on monkeys, demonstrating the effect of prior experience upon learning ability itself (Harlow, 1949). Through the formation of learning sets, the animals were able to learn the solution of more complex problems because of their prior experience in solving simpler problems of a similar nature. By means of this problem-solving experience, the animal thus "learns how to learn." Other research has shown that animals exposed to a rich variety of perceptual experience in early life are better subsequent learners than those deprived of such experience (see Beach & Jaynes, 1954, pp. 255-256). It is apparent from all these investigations that early experience may have enduring and far-reaching effects upon behavioral development.⁴

Other investigators have reared infant chimpanzees in a typically human environment, in order to discover how far the animal would develop characteristic human behavior under these conditions. In the most extensive of these studies (Hayes, 1951; Hayes & Hayes, 1954), Viki, a female chimpanzee, lived in the experimenters' home from a few days after birth to the age of six and a half years. In solving problems involving imitation, Viki proved to be as good as human children of her age and clearly excelled a laboratory-reared chimpanzee. She was able to repeat the experimenter's actions at the command "Do this," and also spontaneously imitated several household activities, such as sharpening pencils or prying lids off cans. Viki likewise engaged in spontaneous play with mechanical toys and gadgets as much as did her human companions and proved skillful in the use of tools. On nonverbal tests of intelligence involving formboards, picture puzzles, blocks, and the like, she performed about as well as the human norms for her age.

Viki's only serious stumbling block proved to be the acquisition of language. With painstaking efforts, the experimenters finally succeeded in teaching her to say three words (mama, papa, cup) and to use them in appropriate situations. For most of her social communication, however, Viki resorted to such practices as pointing, imitative movements, or leading persons to the desired object. The experimenters concluded that

⁴For a provocative discussion of some of the implications of such research for the understanding of human intelligence, see Hunt (1961).

the chief source of difficulty was to be found in the ape's inadequate drive for vocal play. The babbling and chattering characteristic of human infants was almost completely lacking in the chimpanzee, despite the fact that she was physically able to produce a wide variety of speech sounds. Although employing sounds in emotional expression, moreover, Viki appeared to experience great difficulty in vocalizing voluntarily.

In the study of *human infants*, experiments that alter the normal course of development must obviously be limited to relatively mild or otherwise acceptable procedures. One approach utilizes the method of co-twin control. In such experiments, one member of a pair of identical twins is given intensive training in some activity, while the other is retained as a control subject and prevented from exercising the function under investigation. In one of the studies conducted by Gesell and his co-workers (Gesell & Thompson, 1941) by this method, stair climbing and cube behavior (including grasping, manipulation, and constructive play with cubes) were studied in a pair of identical female twins 46 weeks old at the beginning of the experiment. The trained twin (T) was put through a daily twenty-minute training period in both types of activity for six weeks. At the end of this period, the control twin (C), who had had no specific training in these functions, proved equal to T in cube behavior.

In stair climbing, a difference was found between the twins. Whereas T was a relatively expert climber, her sister could not reach the top of a five-tread staircase even with assistance. Two weeks later, however, still without any training, the control twin was able to climb to the top unassisted. At this age (53 weeks), twin C was herself given a two-week training period, at the end of which her climbing skill was about equal to that of T. Such a finding illustrates a common observation that, if training is provided when the individual is physically ready for it, progress is likely to be more rapid than if the training is given earlier.

Another approach is through a study of the comparative development of children who have been reared in culturally deprived and psychologically restricted environments (see Anastasi, 1958, pp. 107-114, 306-308, 522-525). This approach is illustrated by case studies of individual children brought up in relative isolation from

normal human contacts, as well as by group surveys of children reared in gypsy caravans, on houseboats, and in remote mountain villages. In all these situations, considerable intellectual retardation has been found, the retardation becoming more severe with increasing age. Several studies of orphanage children have also indicated intellectual retardation, particularly in language development. An important factor leading to such retardation is the limited experience and insufficient adult contact provided by most institutional environments.

A detailed analysis of the development and daily activities of infants in four orphanages in the Middle East indicated that lack of specific learning opportunities accounted for their behavioral retardation (Dennis, 1960; Dennis & Najarian, 1957). In a special investigation of motor development among these children, it was found that retardation in sitting and walking was associated with a paucity of adult handling. Holding a child in a sitting posture facilitates his learning to sit up alone. Placing him in a prone position tends to induce creeping, which is usually a preliminary to walking. In those institutions where severe retardation in these motor functions was observed, children were customarily fed and cared for in a supine position. The findings of these institutional studies highlight the contribution of experience to the development of infant behavior.

Research with older children and adults has revealed the effects of *schooling* upon intellectual development. Some studies have demonstrated a significant improvement in intellectual functioning as a result of preschool education on the part of orphanage children (McNemar, 1945; Wellman & Pegram, 1944) and other mentally retarded groups (Kirk *et al.*, 1958). For children living in intellectually superior home environments, however, attendance at a nursery school or kindergarten has a negligible effect upon their intellectual performance, although it may improve their emotional adjustment and socialization (see Anastasi, 1958, pp. 200-205).

Among adults, it is a well-established fact that intelligence test scores are closely related to amount of schooling completed. Surveys conducted in the American Army during World Wars I and II, for example, yielded correlations of .73 and .74, respectively, between intelligence test scores and highest grade reached in school (see

Anastasi, 1958, p. 206). Such correlations may of course result from progressive selection of the brighter individuals in the educational system, as well as from the effects of education upon intellectual development. Longitudinal investigations involving the retesting of the same persons after periods of ten to thirty years have provided a more direct approach to the problem. Follow-up studies conducted with New York City elementary school graduates (Lorge, 1945), American college students (Owens, 1953), and Swedish military inductees (Husén, 1951) agree in finding that subjects who continue their education longer show larger average gains in intelligence test scores than do those with less intervening education.

Relevant data are also provided by long-range studies of the intellectual level of populations. When approximately comparable samples of the same populations have been examined over long time intervals, the later groups have generally shown a significant rise in mean intelligence test scores. This trend is illustrated by surveys of nearly complete samples of eleven-year-old Scottish children tested in 1932 and 1947 (Scottish Council for Research in Education, 1949), by a study of American high school students over a twenty-year period (Finch, 1946), and by a comparison of the intelligence test performance of American soldiers during World Wars I and II (Tuddenham, 1948). These gains in tested intelligence paralleled improvements in schooling and in socioeconomic level in the populations studied. When local circumstances produced more rapid progress in social and educational conditions, gains in test scores were especially conspicuous, as illustrated by an eleven-point gain in mean IQ found in one rural American community over a ten-year period (Wheeler, 1942).

STATISTICAL ANALYSIS OF FAMILY RESEMBLANCES AND DIFFERENCES

Because of the inapplicability of selective breeding techniques and the difficulties in the way of employing other procedures under experimentally controlled conditions, research on the contribution of heredity and environment to human behavior has relied chiefly on statistical studies of family resemblance (Anastasi, 1958, Ch. 9; Fuller & Thompson, 1960, Ch. 4). That such resemblances do not in themselves demonstrate the influence of heredity was already noted in an earlier section of

this chapter. Members of the same family tend to have many common features in their environment, such as socioeconomic level, geographical and cultural milieu, and the like. The closer the hereditary relationship, moreover, the greater the environmental proximity. Thus parents and children, as well as brothers and sisters, usually live in the same home; more distant relatives, such as uncles and nephews, tend to have less environmental community than the former, but more than would be found among unrelated persons chosen at random. Not only are related persons exposed to common environmental stimulation because of similar living conditions, but they also constitute in part each other's environment and may become more alike in some respects through such mutual interaction.

Another important factor that tends to increase family resemblances is social expectancy. The child is often reminded of the special talents or defects of his forebears, and any chance manifestation of such traits on his part is augmented by such references. The fact that he is expected to have "inherited" his father's business acumen or his grandmother's sense of humor will tend to influence the individual's own self concept. And this in turn is likely to affect his subsequent development.

Studies of talented families and of feeble-minded families—as in the classic examples of the Jukes and the Kallikaks—merely show a strong tendency for certain traits to run in families. Whether such familial concentration of talents or defects results from hereditary or from environmental factors cannot be established from family histories alone. Psychological traits can rarely be subjected to the type of pedigree analysis employed in studying the inheritance of such traits as blood type or taste blindness (inability to taste certain substances). When a trait is transmitted through a single gene, it is a relatively easy matter to check the pattern of its occurrence in different generations of a family against the patterns expected according to various genetic mechanisms, such as dominant-recessive, sex-linked, and so on. Apart from the demonstration of a hereditary basis for certain rare forms of mental deficiency and a few other pathological conditions, however, analyses of this sort have found little use in psychology. Chief among the obstacles met in their application is the large number of hereditary factors contribut-

ing to most behavior functions. The result is a normal distribution of the trait under investigation, rather than a few clearly identifiable types.

Intrafamilial resemblance in psychological traits has usually been investigated by correlating psychological test scores of large groups of related persons. On intelligence tests such as the Stanford-Binet, parent-child as well as sibling correlations cluster around .50 (see Anastasi, 1958, Ch. 9). The more highly verbal tests tend to yield higher correlations than performance and other aptitude tests. In personality traits, correlations are generally positive and significant, although lower than in intelligence (Roff, 1950). In general, familial correlations run higher in interests and attitudes than in emotional traits, such as dominance, stability, and introversion. It is also noteworthy that daughters tend to resemble both parents in attitudes and opinions more closely than sons do. Such a finding suggests that in our culture the psychological climate of the home influences girls more than it does boys.

The comparison of identical (monozygotic) and fraternal (dizygotic) twins has received particular attention in the analysis of hereditary and environmental contributions to behavior (Cattell, Stice, & Kristy, 1957; Cohen, Vandenberg, & Falkner, 1962; Husén, 1959; Husén, 1960; Thurstone, Thurstone, & Strandskov, 1953; Vandenberg, 1962). The degree of resemblance found between identical twins has been compared with that found between fraternal twins and between siblings, not only in intelligence tests but also in tests of many different aptitudes and personality traits. Since identical twins have the same genes, any differences between them can be ascribed to environment. Fraternal twins, on the other hand, are no more alike in heredity than ordinary siblings. Being of the same age, however, fraternal twins tend to have more similar environments than siblings.

Correlations between intelligence test scores of identical twins are generally close to .90, being nearly as high as the correlations between test and retest scores of the same individuals. Fraternal twin correlations in intelligence test scores cluster around .70, falling midway between the identical twin correlations and those of siblings. Although traditionally the identical-fraternal twin comparison has been emphasized more than that between fraternal twins and siblings, the latter can be in-

terpreted with more certainty. Thus the difference of .20 between the intelligence test correlations of siblings and those of fraternal twins can only result from the greater environmental similarity of the latter. The corresponding difference of .20 between identical and fraternal twin correlations, however, permits no such clear-cut explanation. Available data from several investigations suggest that the greater hereditary similarity of identical twins is paralleled by closer personal contacts and more shared experience (see Anastasi, 1958, Ch. 9; Husén, 1959). Either heredity or environment or a combination of both could thus account for the obtained difference.

Of particular interest are case studies of identical twins who happen to have been reared apart (see Anastasi, 1958, Ch. 9; Shields, 1958; Shields, 1962). About a hundred pairs have been located and examined by different investigators. One of the most extensive surveys was that conducted by Newman, Freeman, and Holzinger (1937). In this study, nineteen pairs of identical twins, most of whom had been separated under the age of one year, were compared with fifty identical and fifty fraternal twins reared together. Stanford-Binet IQ's correlated .77 between the separated identicals, in contrast to .88 between non-separated identicals and .63 between non-separated fraternal twins. The correlation between separated identicals probably resulted in part from selective placement, since the members of any twin pair tended to be placed in similar foster homes. When the environments were rated for educational advantages, a correlation of .79 was found between intrapair differences in educational advantages and in IQ. Thus in those pairs in which the separated twins were reared in clearly dissimilar environments, large differences in IQ resulted; but in the majority of cases, the homes were similar and IQ differences were slight.

Because of similar methodological difficulties, research on foster children has led to somewhat conflicting interpretations (see Anastasi, 1958, Ch. 9). The intelligence of foster children tends to be higher than would be anticipated from a knowledge of their backgrounds, a fact that may reflect the favorable influence of the foster homes. Significant correlations have been found between the intelligence test scores of foster children and those of both their foster parents and their own parents (when data on the latter were available).

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It is difficult to determine to what extent a child's resemblance to his foster parents results from environmental influences of the foster home and to what extent it results from selective placement. Adoption agencies try to "fit the child to the home," that is, they match the characteristics of the foster home as closely as possible to those of the child's own background. Another difficulty arises from a restriction in the range of foster home environments. Because children are not placed in homes considered undesirable, foster homes are usually more homogenous in quality than are homes in general. Such a restriction in range would have the effect of underestimating the influence of home environment.

Although studies of twins and foster children permit a fuller analysis of hereditary and environmental influences than is possible through other familial studies, their findings have so far proved to be only suggestive. The complex interplay of many variables in actual family situations prevents a definitive interpretation of results.

AGE AND HUMAN ABILITY

Behavioral differences among the infant, the teenager, the adult in his prime, and the octogenarian are fully as conspicuous as the differences in their physical appearance. Much of the psychology of childhood and adolescence is concerned with the changes that typically occur as the individual grows up. Today, the rapid advance of research on maturity and old age is helping to fill in our knowledge of the entire life cycle. Psychologists have charted age changes in motor skills, perceptual functions, intellectual capabilities, social and emotional traits, interests, and attitudes over various life periods (see Anastasi, 1958, Ch. 8; Welford, 1958). For purposes of illustration, however, this section will concentrate on changes in intelligence test performance, since these changes have been most fully explored over the whole life span.

The term "growth" has traditionally been employed to designate age changes occurring prior to maturity. When we speak of "growth," we usually think of an orderly sequence of development in the physical characteristics of the individual. As the child grows older, for example, his height increases, his bodily proportions are altered, and other physical changes take place. As structures

become altered with age, we may expect their functions also to undergo change. With stronger muscles the older child can learn to walk, climb stairs, and perform various other tasks more readily than he could when he was younger. Intensive training at an earlier age may produce negligible effects in comparison with the progress of an older child with only a minimum of training. Even in the simple sensorimotor development of the infant, however, experiential factors influence the individual's progress, as demonstrated by some of the studies cited in the preceding section.

In the behavior development of the older child, learning plays an increasingly important part. When we apply the term "growth" to behavior, it must be understood that we mean a series of changes that may result largely from learning. Experiential factors likewise play an important part in any intellectual decline or other psychological changes that occur in later life. Although in extreme old age physiological deterioration may impair psychological functioning, much of the decline ordinarily found in older persons probably has an experiential basis. It is not enough to know how old the person is; we need to ask also what he has been doing during those years.

CROSS-SECTIONAL VERSUS LONGITUDINAL APPROACHES

Because repeated examination of the same persons over long periods of time presents many practical difficulties, studies of age changes have frequently employed cross-sectional procedures. For instance, children ranging in age from 8 to 16 years may be tested simultaneously and the mean score of each age group plotted against age. It is assumed that the resulting growth curve approximates that which would have been obtained if the 8-year-olds had been retested annually until they reached age 16.

This assumption is questionable for at least some groups. Different age groups may not be comparable because of *selective factors*. High school seniors, for example, are usually more highly selected than high school freshmen, since the poorer students tend to drop out of school. Under these conditions, the higher mean score of the older subjects results partly from selection. The apparent gain in score with age will thus be larger than it would have been if the same subjects had been retested.

Another objection to cross-sectional procedures is that the *experiential backgrounds* of different age groups may be dissimilar. This is particularly true when the groups to be compared differ widely in age. Thus the differences between today's 40-year-olds and today's 20-year-olds could not be attributed entirely to factors associated with age. At the time when the present 40-year-olds were 20, the educational level of the population was lower, opportunities for certain kinds of activity were less frequent or even non-existent, and many social attitudes were probably quite different from those prevalent today. Such age comparisons are thus complicated by the fact that older and younger groups were brought up under different conditions, owing to intervening cultural changes. A further limitation of cross-sectional methods is that they can provide only *average results*, making analysis of individual changes impossible.

On the other hand, the longitudinal approach is not entirely free from methodological difficulties. When follow-ups cover a period of several years, the *shrinkage in sample size* may be considerable. Moreover, those subjects who do remain in the study are likely to be *selected* with regard to stability of residence and continued cooperation with the investigator. Persons selected in terms of these conditions often differ from those who drop out in a number of related characteristics, such as cultural level of the home, parent-child relations, interests, and attitudes. For these reasons, samples employed in longitudinal studies tend to be somewhat superior to the general population. The reverse may be true of institutional samples, such as orphanage children. In this situation, the more intelligent or better adjusted children are more likely to be removed for adoption. The remaining sample would thus represent an inferior selection. In either case, generalizations from the longitudinal sample to the total population must be qualified in terms of any selective factors that may have operated. At the worst, however, such selection limits the scope of the results. It does not invalidate them if the population to which they apply is clearly specified.

A further methodological problem concerns the effect that *participation in the study* may have upon the subjects' development. Test-taking practice, repeated contacts with the project staff, identification with a special group, and similar conditions associated with the study may affect the

subjects' test performance, attitudes, emotional adjustment, and other characteristics. On the whole, however, the weaknesses of the longitudinal approach are less serious and more often remediable than are those of the cross-sectional approach. As more research facilities become available to psychologists, increasing use is being made of long-range longitudinal procedures. Several major longitudinal projects have already yielded a wealth of data (see Anastasi, 1958, Ch. 8).

THE COURSE OF INTELLECTUAL DEVELOPMENT

Longitudinal studies of age changes in performance on traditional intelligence tests reveal a slow rise in infancy, followed by more rapid progress in childhood and eventual slowing down as the upper limit is approached in the late teens or early twenties. It should be noted, however, that intelligence tests measure a composite of several abilities and that the nature of this composite varies with age. In infancy, intelligence is measured largely in terms of sensorimotor development; in later childhood, verbal and other abstract functions play an increasingly prominent part in intelligence test performance.

If the individual advances regularly from year to year and maintains the same relative position in his age group, his intelligence quotient (IQ) will remain approximately constant. Several longitudinal studies have provided data on long-range constancy of the IQ on such intelligence tests as the Stanford-Binet (see Anastasi, 1958, Ch. 8; Terman & Merrill, 1960). In a follow-up of subjects from the Stanford-Binet standardization sample, children originally examined between the ages of 2 and 5½ years were retested after ten and twenty-five years (Bradway, Thompson, & Cravens, 1958). Initial IQ's correlated .65 with ten-year retests and .59 with twenty-five-year retests. The correlation between the ten-year retest (mean age = 14 years) and the twenty-five-year retest (mean age = 29 years) was .85.

In terms of group trends, the long-range predictive validity of an IQ on such tests as the Stanford-Binet, especially when obtained with school-age children, is remarkably high. In individual cases, however, large upward or downward shifts in IQ may occur over an interval of a few years. In one extensive longitudinal project (Honzik, Macfarlane, & Allen, 1948), individual IQ changes of as much as 50 points were observed. Between

the ages of 6 and 18, when retest correlations are generally high, 50 per cent of the cases changed by 15 or more IQ points, 37 per cent by 20 or more points, and 9 per cent by 30 or more points. Nor were these changes random or erratic in nature. Some children exhibited consistent upward or downward trends extending over several years. Large shifts in IQ were usually associated with the cultural milieu and emotional climate in which the child was reared. Children in underprivileged environments tended to lose and those in superior environments to gain with age, in relation to the general norms.

Severe illness, changes in home and familial conditions, therapeutic and remedial programs, and other major environmental variables operating during childhood are likely to be reflected in sharp rises or drops in individual IQ's. Certain motivational and attitudinal characteristics of the children themselves also help to explain major shifts in IQ. For example, in an intensive longitudinal study in which 140 children were tested annually between the ages of 3 and 10 years, gains in IQ were found to be associated with high achievement drive, competitive striving, and curiosity about nature (Sontag, Baker, & Nelson, 1958).

ADULT INTELLIGENCE

Cross-sectional studies of the intelligence test performance of adults of different age levels have typically shown a peak in the twenties followed by a gradual decline until 50 or 60 and a steeper decline thereafter. These findings are illustrated in Fig. 8-3, showing mean scores on the Wechsler Adult Intelligence Scale (WAIS) obtained by different age groups in the standardization sample. The data for ages 17 to 60 are based on a large and highly representative national sample; the sample tested beyond age 60 was limited to a single state and was somewhat less representative.

Because of the rising educational level of the American population during the past fifty years, the older subjects in the WAIS standardization sample had received less education on the average than had the younger subjects. It is therefore likely that the observed decline in mean score results not from age but from educational differences. Some support for this hypothesis is provided by a comparison of the standardization data of the WAIS with those of the earlier form (Wechsler-Bellevue), standardized some fifteen

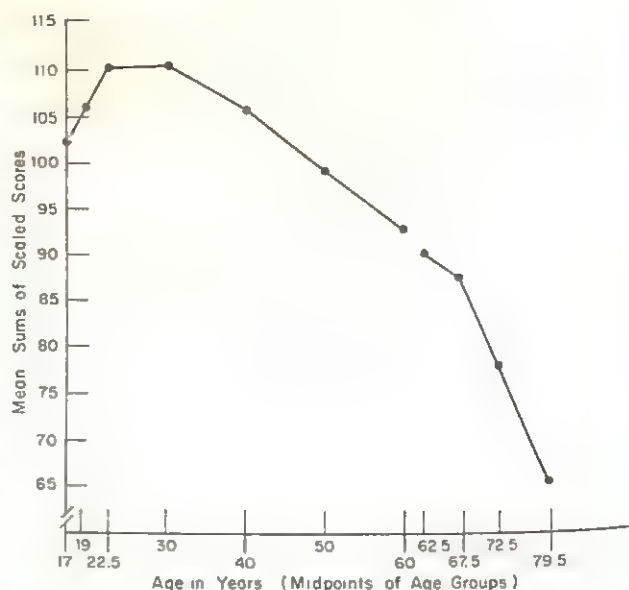


Fig. 8-3 Mean scores of different age groups on Wechsler Adult Intelligence Scale. (Adapted from Doppelt and Wallace, 1955, p. 323.)

years earlier. Both samples show a decline in score during adulthood, which closely parallels the decrease in educational level in the successive age groups. But in the more recently tested WAIS sample, improvement continues longer and decline sets in at a later age than in the Wechsler-Bellevue sample. This finding is in line with the educational differences between the two standardization samples and reflects intervening educational changes in the population. Also relevant is the fact that, in surveys with other tests, age decrements tend to disappear when older and younger persons are matched in education (Miner, 1956).

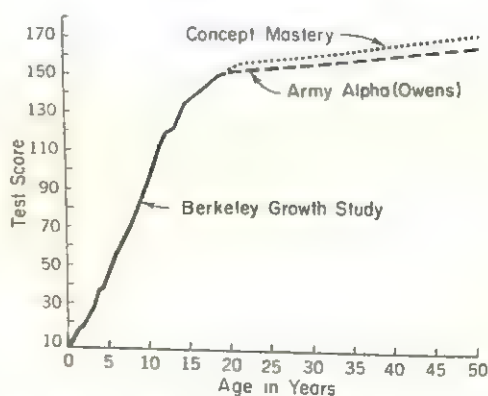


Fig. 8-4 A composite age curve of intelligence from birth to fifty years. (From Bayley, 1956, p. 816.)

Among superior adults, selected in terms of initial IQ or educational level (e.g., college graduates), neither cross-sectional nor longitudinal studies reveal any age decrement in intelligence test scores (Bayley, 1955; Ghiselli, 1957; Nisbet, 1957). These findings are illustrated in Fig. 8-4, which combines the results of three longitudinal studies in a composite age curve extending from birth to 50 years. Both adult samples included in this graph were intellectually superior. It will be seen that, rather than showing any decline, the curve continues to rise throughout the period covered.

Longitudinal data on older persons of more limited ability are meager, but it is to be expected that such persons would show some age decrement on typical intelligence tests. The functions covered in these tests are largely those developed in school. Adults whose occupations do not require the exercise of verbal, numerical, and other abstract intellectual functions are thus likely to show increasing loss in these tests as more and more time elapses after the completion of their own schooling. There is some evidence to suggest that even average adults may show a rise rather than a decline in tests calling for practical information, judgment, and social perception (Deming & Pressey, 1959). Moreover, among elderly persons, relative performance on different types of tests bears some relation to the individual's past occupation, hobbies, and skills (Williams, 1960). Thus selective lack of practice may account for age deterioration in at least certain functions.

PHYSIQUE AND BEHAVIOR

For simplicity, the term "physique" is herein used to refer collectively to all organic characteristics, including anatomical, physiological, and biochemical properties of the organism. The relationship between physique and behavior concerns the differential psychologist for both theoretical and practical reasons. Study of the part played by physical factors in the development of aptitudes and personality advances our understanding of the causes of behavioral differences. Insofar as heredity contributes to behavioral differences, moreover, identifying the physical bases of such differences is an important step in tracing the long and complex path from gene to behavior. From a practical standpoint, interest in the relationship between

physique and behavior stems from the possibility of assessing people and predicting behavior on the basis of physical characteristics.

In evaluating the results of any study of the relationship between physique and behavior, we must bear in mind that correlation does not indicate causation. When a significant association is established between a physical and a behavioral characteristic, it may mean that the physical condition influences the behavior in question, or that the behavior influences the physical condition, or that both result independently from the common influence of a third factor. In any given situation, of course, more than one of these causal mechanisms may operate in combination. We shall consider examples of each of these three types of relationship between physique and behavior.

INFLUENCE OF PHYSIQUE UPON BEHAVIOR

The many ways in which physical factors influence behavior development may be arranged along a continuum, ranging from relatively direct and rigidly limiting control to highly indirect and flexible relationships. The former extreme may be illustrated by neurological, glandular, and metabolic disorders (of either hereditary or environmental origin) that lead to severe behavioral pathology. The abnormally small brain of the microcephalic idiot, the underactive thyroid of the cretin, and the metabolic disorder of the phenylpyruvic ament are examples of this mechanism. In all these cases, the individual lacks the minimum physical prerequisites for normal behavioral development. Unless the physical condition can be corrected at an early developmental stage (as through dietary control of phenylketonuria), behavioral deficiencies will result. However, we cannot argue directly from these pathological cases to individual differences within the normal range of variation. Beyond a certain essential minimum, further differences in physical conditions are not necessarily accompanied by corresponding differences in behavior. To put it differently, the organic equipment of most persons permits a very wide latitude in behavioral development.

Within the normal range, research on the relation between individual differences in neurological, glandular, metabolic, and other specific physical factors on the one hand and behavioral traits on the other has so far yielded meager evidence of significant association (see Anastasi, 1958, Ch. 5).

In this connection, there has been a growing interest in the possibilities of biochemical investigation. An impressive body of data has been accumulated to show that individuals differ widely in metabolic patterns, as indicated by marked variations in the proportion of different constituents of saliva and urine (Williams, 1956). Although there has been some speculation about possible relations between such "biochemical individuality" and behavioral characteristics, little empirical evidence of such association is so far available (see, e.g., King, Boroman, & Moreland, 1961). Much more research is needed before any conclusions can be drawn about the contributions of biochemical differences to *normal* behavior development.

It is likely that group surveys may fail to reveal the role of many physical factors in behavior development because the relation is usually indirect and variable. In other words, the same physical condition may lead to very dissimilar effects in different individuals, because of its interaction with other factors. Thus blindness or deafness, orthopedic disabilities, or prolonged and incapacitating illness may have different effects upon intellectual and emotional development depending upon other concomitant circumstances. All these conditions may, for instance, seriously retard intellectual development by interfering with educational processes. Through special adaptations of instructional procedures, however, retardation may be prevented. Similarly, body build and other aspects of physique may influence behavior through limiting or facilitating the individual's participation in athletic, social, intellectual, and other types of activity.

Physique may also influence behavior through the mechanism of *social stereotypes*. The individual's visible physical characteristics serve as social stimuli, which evoke differential responses from his associates. They may thus affect the attitudes he encounters, the opportunities he receives, and the shaping of his own self concept. Through these channels, his behavior may gradually come to approximate that associated with the stereotypes. There is growing recognition of the importance of all these indirect effects of physique upon behavior, for which Barker and his associates (1953) coined the term "somatopsychological effects." Social stereotypes and other somatopsychological

effects may account in large part for the small but significant association found between body build and personality traits and cited in support of such constitutional type theories as that of Sheldon (Anastasi, 1958, Ch. 6; Sheldon & Stevens, 1942; Wells & Siegel, 1961).

INFLUENCE OF BEHAVIOR UPON PHYSIQUE

Some empirically established relations between physical factors and behavior may result, not from the effect of physique upon behavior, but from the reverse effect of behavior upon physique. In this relationship, too, the influence may operate through a variety of mechanisms. The powerful shoulder muscles of the swimmer and the scholar's stoop, for example, reflect the effects of habitual activity. Smiles and frowns eventually leave their marks upon the human countenance. Studies of immigrant groups have demonstrated that such characteristics as stature and skull shape may be influenced by dietary habits, child-rearing practices, and other culturally determined experiences of the individual (see Anastasi, 1958, Ch. 16). Additional examples are provided by the many physiological changes occurring during emotional excitement. Although themselves temporary, such physiological changes may produce permanent effects if they occur repeatedly and with sufficient intensity.

Of particular interest in this connection are *psychosomatic disorders*. These are physical disorders in whose development psychological factors are believed to play an important contributing part. Gastric ulcers, asthma, and allergies are among the most widely recognized psychosomatic diseases, although psychological conditions are now considered as possible contributing factors in almost every known illness. In general, anxiety, tension, and emotional stress are the psychological factors most commonly associated with psychosomatic disorders.

Another example of the influence of behavior upon physical condition is provided by research on the physical characteristics of schizophrenics. Significant differences have been found between groups of schizophrenics and normal controls in a large number of organic factors. Although eventually these findings will undoubtedly contribute to our understanding of the causes of schizophrenic disorders, at least some of the differences may

represent the physical effects of schizophrenic behavior. Organic differences between schizophrenics and normals *may* result from emotional stress, degree of activity, nutritional state, and other variables associated either with the psychotic condition itself or with institutionalization (Horwitt, 1956; Kety, 1959).

It was found, for example, that the serum of schizophrenics oxidized adrenaline more rapidly than did that of normal controls. Further investigation, however, revealed that this difference resulted from a vitamin C deficiency in the diet of the institutionalized schizophrenic cases (Angel, 1957). When this variable was controlled, the difference between schizophrenics and normals disappeared. Several other biochemical differences between schizophrenics and normals likewise disappeared when checked in a well-designed study in which schizophrenic and control subjects lived under closely controlled and comparable environments for the duration of the project (Kety, 1959).

INFLUENCE OF A COMMON FACTOR UPON PHYSIQUE AND BEHAVIOR

The third possible type of relationship between physique and behavior is that in which association results from the common influence of a third factor. One of the clearest examples of this sort of relationship is provided by socioeconomic level. Thus the child reared in a superior home has richer opportunities for intellectual development, as well as better diet, hygiene, and medical care than the child who grows up in a city slum or poor rural area. Consequently, some positive correlation will be found between intelligence and a number of physical conditions within a socially and economically heterogeneous group. The correlation may disappear, however, if socioeconomic level is held constant.

The influence of socioeconomic factors accounts in large part for the association between miscellaneous physical defects and intelligence often found in large-scale surveys of school children (see Anastasi, 1958, Ch. 5). Such defects as infected tonsils, adenoids, enlarged glands, dental caries, malnutrition, and skin disorders tend to be most frequent among the dull and least frequent among the bright children. Similar results are obtained whether the children are classified on the

basis of school grades or IQ on an intelligence test. Total number of defects per child also tends to be highest among the dull and lowest among the bright, while the number of children free from any defect is highest in the bright and lowest in the dull group. In the past, findings such as these have led to much theorizing about underlying constitutional factors and about the effect of local infections upon mental activity. When socioeconomic differences have been ruled out, however, the association between physical defects and intelligence usually disappears.

DISTRIBUTION OF INTELLIGENCE

FORM OF THE DISTRIBUTION

In most human traits, individual differences are quantitative rather than qualitative. In other words, individuals are distributed along a continuous scale, rather than falling into a few distinct types. Moreover, the distribution of most traits—both physical and psychological—generally approximates the bell-shaped *normal probability curve*. This curve is illustrated in Fig. 8-5, which shows the distribution of Stanford-Binet IQ's of nearly three thousand children tested in the standardization of this test. The height of the curve indicates the percentage of cases falling within each class interval of IQ's designated on the baseline. It will be noted that the largest number of cases cluster around the center of the range and the number decreases gradually as the extremes are approached.

First derived by mathematicians in their study of probability, the normal curve is obtained whenever the variable measured is the composite result of a very large number of independent and equally weighted factors. In view of the extremely large number of genes and of environmental factors that contribute to the development of intelligence in the general population, it is reasonable to expect that IQ's should be distributed in accordance with the normal curve. When distributions found in actual practice deviate significantly from normality, the reason is often found either in the unrepresentativeness of the sample examined or in the unsuitability of the test. If the test has inadequate "ceiling," for example, the brighter per-

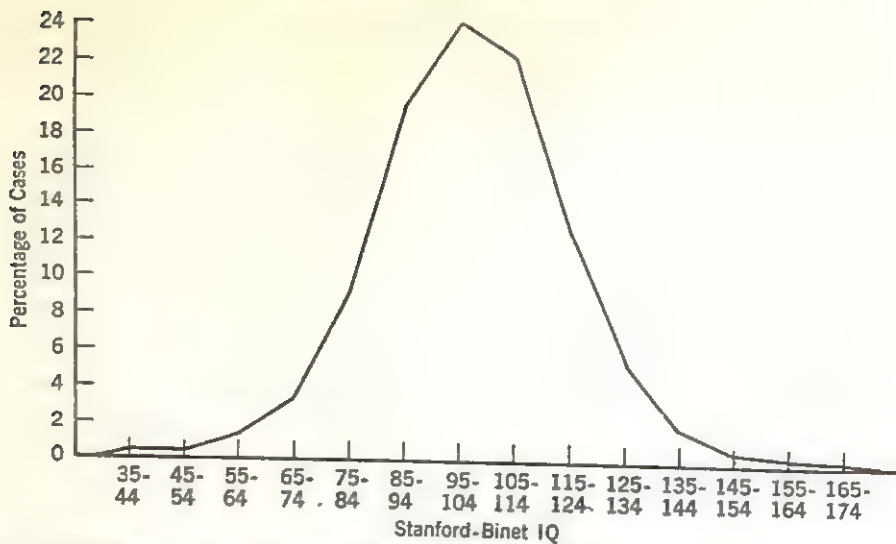


Fig. 8-5 Distribution of Stanford-Binet IQ's of 2904 children between the ages of 2 and 18. (From Terman and Merrill, *Stanford-Binet Intelligence Scale, Manual for the third revision Form L-M*, 1960, p. 18. By permission of Houghton Mifflin Company.)

sons tend to pile up at or near a perfect score and the distribution will be skewed toward the low end rather than symmetrical. Similarly, if the test "floor" is too high for the group tested, the less able persons will pile up at or near a zero score and the distribution will be skewed toward the high end.

The intellectually superior and the mentally deficient represent the upper and lower extremes of the distribution of intelligence. Because the distribution is continuous, there is no sharp or clearly defined separation between these groups and the normal. The cutoff points employed to define these groups are arbitrary; borderline cases can be found that bridge the gap between any categories that may be chosen.

MENTAL DEFICIENCY

In terms of intelligence test performance, mental deficiency is customarily identified with IQ's of 70 or less. Approximately 2 to 3 per cent of the general population fall into this category. Further subdivisions are traditionally made into three levels of subnormality: mild (IQ 50-70), moderate (IQ 20-50), and severe (IQ below 20). A more functional classification that is coming to be applied more and more recognizes those cases requiring custodial or nursing care, those that are trainable by individual procedures, and those that are educable in special classes. Increasing efforts are being made to train and rehabilitate mental defec-

tives at all levels. Such programs are meeting with more success than was heretofore thought possible (see Anastasi, 1958, Ch. 12; Campbell, 1960; Hutt & Gibby, 1958; Sarason, 1959).

While IQ's on such tests as the Stanford-Binet and the WAIS constitute a major criterion in the identification and classification of mental defectives, it must be emphasized that decisions regarding the disposition and treatment of individual cases ought always to take much more into account. Such decisions should be based upon a comprehensive study of the individual's intellectual level, social competence, educational history, physical condition, familial situation, and other pertinent data. Especially within the borderline level, a person with a lower IQ may be better able to adjust to independent community living than one with a higher IQ, provided that other concomitant circumstances are more favorable in the former case.

With regard to causation, one distinction that has been proposed is that between unifactor and multifactor mental deficiency (see Anastasi, 1958, Chs. 2 and 12; Dingman & Tarjan, 1960; Roberts, 1952). The unifactor cases are extreme deviants, exhibiting both organic pathology and intellectual defects which are traceable to a single defective gene or a major environmental disturbance. The multifactor defectives, on the other hand, represent merely the lower end of the normal distribution of intelligence. They manifest varying degrees

of deficiency, depending upon the particular combination of adverse hereditary and environmental factors in each individual case. Since the unifactor defectives are added on to the multifactor defectives at the lower end of the distribution, the frequency of low IQ's should exceed that expected in a mathematically derived normal probability curve. Large-scale surveys of the distribution of IQ's in several populations do in fact reveal such a deviation from normality at the low end of the scale (Dingman, 1960; Roberts, 1952).

SUPERIOR INTELLIGENCE

In the description of persons of superior ability, several terms have been employed with somewhat different implications. The intellectually "gifted" are commonly identified on the basis of high IQ on intelligence tests and superior academic achievement—two indices that are highly correlated. Terman and his associates at Stanford University (Terman & Oden, 1959) have helped to establish this usage of the term "gifted" through their monumental longitudinal study of approximately 1000 California children with Stanford-Binet IQ's of 140 or higher. IQ's at this level are obtained by slightly more than 1 per cent of persons tested in the general population.

The findings of the Stanford study, which have been corroborated by other less extensive studies conducted elsewhere, revealed the gifted child as typically successful in school, healthy, emotionally well-adjusted, having wide interests, and excelling his average classmates in nearly every trait measured. Although there were individual exceptions, the group as a whole clearly dispelled the early popular stereotype of the intellectually gifted child as weak, sickly, timid, and narrowly specialized. As they grew into maturity the California group of gifted children amply fulfilled their youthful promise in outstanding adult achievements.

Another term employed to designate persons of superior ability is "talented." Usually this term refers to superiority within a specialized field and is perhaps most often applied to areas not covered by traditional intelligence tests, such as musical, artistic, or mechanical aptitudes. It should be noted that all degrees of generality or specialization of excellence may occur in reality. This follows from the fact that intercorrelations among different abilities are neither highly positive nor highly negative. Rather the abilities are relatively independent of each other. Thus a few individuals

may excel in a large number of traits, as in the classic example of Leonardo da Vinci; some may excel in only a few traits; and still others may exhibit a single talent to a high degree, while being average or inferior in other respects.

The term "genius" is generally reserved for very high and rare degrees of superiority. With regard to intellectual performance, for example, a minimum IQ of 180 was proposed by one investigator (Hollingworth, 1942). Among persons scoring at this very high level, personality difficulties are more likely to occur than at levels nearer the average. The wide gap between the individual's intellectual level and that of his associates increases difficulties of intercommunication. In childhood, moreover, the large disparity between the individual's mental age and his level of physical and social development is a further source of difficulty. Even in these extreme deviants, however, maladjustment may be prevented through appropriate educational practices and parental attitudes.

Since midcentury, the most conspicuous development in the investigation of superior deviates is to be found in research on creativity. That outstanding intellectual achievement calls for more than a high IQ or superior academic performance has always been implicitly assumed. But systematic psychological research on the nature of creativity itself is of recent origin. Following a variety of approaches, psychologists are now intensively studying the characteristics of creative persons (including adults and children), as well as methods for identifying and developing creative abilities in all areas and at all levels (Barron, 1963; Getzels & Jackson, 1962; Golann, 1963; Guilford, 1959b; McKinnon, 1962; Taylor & Barron, 1963; Torrance, 1962). Although current research on creativity is yielding a wealth of data with important practical and theoretical implications, we must guard against exaggerating the distinction between creativity and intelligence as traditionally measured. To be sure, neither a high IQ on current intelligence tests nor high academic achievement is identical with creativity. These qualifications do not ensure that an individual will make outstanding contributions. On the other hand, they do not preclude creativity nor are they completely unrelated to it. Traditional intelligence tests, with their predominant emphasis on comprehension and retention, show a moderate but significant positive correlation with measures of creativity. Rather than differentiating between "intelligence" and

"creativity," moreover, we need to broaden the concept of intelligence to include newly identified creative traits.

NATURE OF INTELLIGENCE

While intelligence has been popularly identified with an IQ on an intelligence test, psychologists have been studying its composition and organization for over half a century (see Anastasi, 1958, Chs. 10 and 11; Guilford, 1959b; Kettner, Guilford, & Christensen, 1959). In preparing an intelligence test, the psychologist is inevitably influenced—either implicitly or explicitly—by his ideas of what constitutes intelligence. Thus intelligence tests do reflect at least partly the prevailing concept of intelligence. Nevertheless, once an intelligence test has undergone the years of preparation and standardization required to bring it to completion, it may tend to codify and freeze a particular concept of intelligence and thereby retard change. Moreover, intelligence tests are designed to meet practical demands within specific settings. Hence they often represent a compromise between practical testing needs and the concept of intelligence that might have developed in the less restricted context of basic research.

Traditional intelligence tests measure largely *scholastic aptitude*, or those abilities that are important for school achievement. Historically, modern intelligence testing began with Alfred Binet's development of a test to investigate the causes of retardation among Paris school children. The current descendants of Binet's test, such as the Stanford-Binet developed in this country, are still among the most widely employed individual tests of intelligence. Group tests were often modeled after the Binet tests and their validity was established by correlating them with Binet IQ. Another criterion against which the validity of intelligence tests is quite generally measured is school achievement itself. Thus the scores on a newly developed intelligence test may be correlated with school grades, teachers' ratings of intelligence, promotion and graduation data, or other indices of academic success. If these correlations are high, the test is considered a valid measure of intelligence; if the correlations are low, the test may be revised so as to make it a better predictor of scholastic performance.

With regard to content, intelligence tests cover

predominantly verbal aptitudes. Arithmetic skills, numerical reasoning, and memory for various kinds of material are also commonly included, but in smaller proportions than the purely verbal items. Different intelligence tests, moreover, may cover somewhat different constellations of abilities. Non-language and performance tests, for instance, frequently make much heavier demands upon spatial visualization, perceptual speed and accuracy, and abstract reasoning than do the usual verbal-type tests. Moreover, some so-called verbal tests are more highly verbal than others. A few have a more nearly uniform distribution of verbal, numerical, and spatial content. Similarly, the extent to which speed affects performance varies widely from one intelligence test to another. These differences in the content of tests that are all designed to measure "intelligence" provide one of the reasons why intelligence test scores should always be accompanied by the name of the test from which they were derived. The IQ is not a property of the organism. It is simply an index of performance on a specific test; and it may have a different meaning when obtained on different tests.

Shortly after the publication of the first intelligence tests, it became apparent that certain aptitudes remained largely unmeasured by these tests. The increasing involvement of psychologists in vocational counseling and in the screening and classification of industrial and military personnel highlighted the need for tests of other aptitudes. As a result, so-called special aptitude tests were developed to supplement general intelligence tests in mechanical, clerical, musical, artistic, and other aptitude areas. At the same time, clinical psychologists, working intensively with individual cases, were impressed with the conspicuous intra-individual differences often found from one intelligence test to another, or among different parts of the same intelligence test. Thus a person might score well on performance but poorly on verbal tests; or within the Stanford-Binet, he might do consistently better on numerical than on verbal tasks. It thus seemed apparent that intelligence tests themselves might include a small number of relatively independent aptitudes in which the same individual could vary appreciably.

These two trends merged in a type of research known as *factor analysis* (see Anastasi, 1958, Ch. 10; Guilford, 1954, Ch. 16). Essentially such research involves the administration of a large num-

ber of different tests to the same individuals. Each person's scores on all these tests are intercorrelated and the resulting correlations are subjected to further statistical analyses to discover which tests tend to cluster together and which are relatively independent. Examples of the abilities or "factors" thus identified include verbal comprehension, word fluency, arithmetic-computational skills, quantitative reasoning, perceptual speed, spatial visualization, and mechanical comprehension. Through factor analysis, what had formerly been called intelligence could itself be subdivided into relatively independent abilities, and these abilities could be recombined with some of those underlying special aptitude tests to provide a more comprehensive picture of intelligence.

One of the outcomes of research on the composition of intelligence has been the development of multiple aptitude batteries. This type of test is designed to fulfill most of the functions served by both intelligence and special aptitude tests. Rather than yielding a single global score, such as an IQ, multiple aptitude batteries provide a profile of scores on separate tests. Most of these tests cover traits identified through factor analysis. An example of such a profile, obtained with the Differential Aptitude Tests (Bennett, Seashore, & Wesman, 1963), is reproduced in Fig. 8-6. This multiple aptitude battery yields scores in Verbal Reasoning, Numerical Ability, Abstract Reasoning, Clerical Speed and Accuracy, Mechanical Reasoning, Space Relations, Language Usage (Spelling and Grammar),

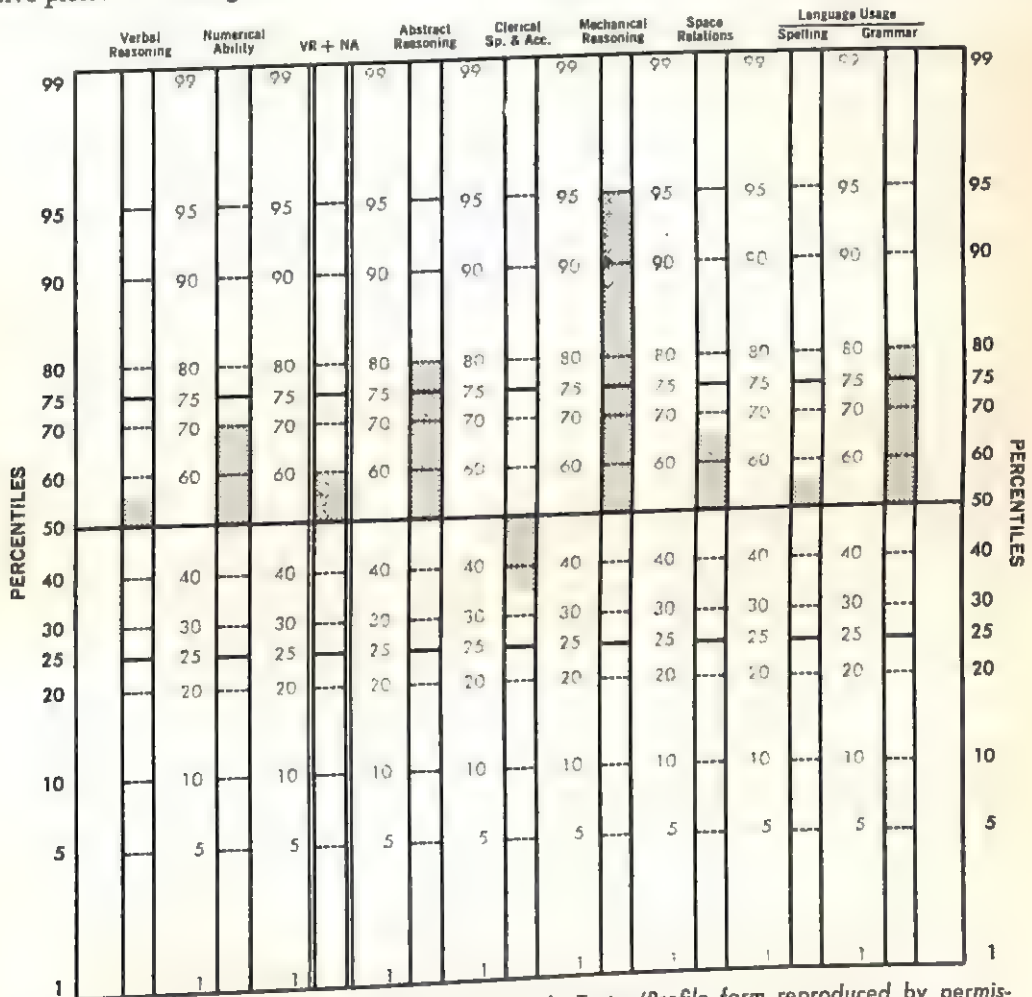


Fig. 8-6 Profile of scores on the Differential Aptitude Tests. (Profile form reproduced by permission of The Psychological Corporation. Copyright © 1961, 1963, The Psychological Corporation, New York, N.Y. All rights reserved.)

addition, the sum of the scores on the Verbal Reasoning and Numerical Ability tests, given in the third column, provides a single index of scholastic aptitude similar to that obtained from most traditional intelligence tests.

Today there are indications that in our culture the concept of intelligence is undergoing further change in at least two directions. First, the boundaries of intelligence are being extended to include more nonverbal aptitudes. This trend may reflect the increasing mechanization of our culture, the do-it-yourself movement, the rising demand for scientists and engineers, and other contemporary developments. Secondly, there is a growing emphasis upon creativity and original thinking, as contrasted with comprehension and retention. Some of the reasons for the latter trend may be found in the increasing application of tests to adults and in the mounting demand for high-level talent.

Several current research projects concerned with creativity have been exploring new testing areas and developing many ingenious new types of tests (see, e.g., Getzels & Jackson, 1962; Guilford, 1959a; Torrance, 1962). So far, these new test materials have not been incorporated to any appreciable extent in commercially available intelligence tests. It is likely, however, that in the near future intelligence tests will begin to reflect the trend toward the testing of creative talents and toward the use of more nonverbal content. Intelligent behavior in our culture is making increasing demands in these two directions. On the other hand, it should not be inferred that intelligence in our culture is becoming predominantly nonverbal. Verbal ability is being supplemented, not supplanted, as a basis for intelligent behavior. We must remember that verbal ability still underlies our principal means of communication and of cultural transmission through education. Moreover, it provides some of the most effective symbols and tools for carrying on abstract thinking. Thus unless civilization should change drastically, verbal ability will undoubtedly remain at the core of human intelligence.

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CHAPTER 9

Differential Psychology: Group Differences

In the preceding chapter, we examined some of the problems and findings pertaining to individual differences in psychological traits and analyzed the principal factors that account for variation from person to person. With this background, we may now turn to some of the major groups into which individuals are commonly classified. We shall thus inquire into the behavioral characteristics associated with an individual's sex, race, nationality, occupational or social class, and other groups with which he is identified.

Social stereotypes concerning such groups have exerted a powerful influence upon interpersonal behavior in daily life—sometimes with tragic results. It is partly to correct certain popular misconceptions that we need objective data on the nature and causes of group differences. To be sure, the multiple and complex determination of the individual's behavioral development should itself make us skeptical about any simple system of characterizing people in terms of their group memberships. Yet all too often an individual is expected to be dependable, or shiftless, or excitable, or a clear thinker, or poor in mechanics simply because such a person is a man or a woman or belongs to a particular race or nation. When beliefs are as deep-rooted and emotionally toned as those regarding group relations, they are not easily dislodged. Direct evidence on the nature of group differences is more convincing than deductions from a general knowledge of behavioral development. From a theoretical standpoint, moreover, the analysis of group differences is a valuable adjunct to the study of individual differences. If psychological differences among groups are investigated with reference to accompanying biological and cultural conditions, the understanding of individual differences is thereby enhanced.

The literature on group differences in behavioral traits is voluminous. Despite this profusion of data, however, our understanding of group differences is seriously limited by the many uncontrolled (and often uncontrollable) conditions under which the data are gathered. In any group comparison, it is especially important to be alert to possible pitfalls of methodology and interpreta-

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tion. For this reason, we shall begin by considering some of the questions that need to be asked in evaluating any study of group differences.

PROBLEMS IN THE INTERPRETATION OF GROUP DIFFERENCES

STATISTICAL SIGNIFICANCE

One of the first questions to ask about any reported group difference concerns the statistical significance of that difference. This question deals essentially with the expected consistency of results. How likely is it that, if the investigation were repeated with different subjects, the original conclusion would be reversed? If girls obtained the higher mean score in the first study, might boys excel in the second study?

A major source of variation in the results of different investigations is to be found in *sampling error*. This chance error, or random fluctuation in the data, arises from the fact that any one investigator employs only a sample of the total population about which he wishes to generalize. For example, if the population under consideration is defined as public school children in American cities, data may be gathered on some 5000 or 6000 children in a dozen schools. From these results the investigator generalizes as to the entire population. If the sampling was carefully chosen to be representative of the given population, such conclusions will not be far in error. The figures thus obtained, however, will not be identical to those that would have been secured by testing the entire population of American city public school children. Nor will results from successive samplings of the same population coincide completely. Had a different sampling of 5000 city public school children been employed, slightly different results would have been obtained.

By appropriate statistical procedures, it is possible to estimate the probable limits within which our results might vary because of chance errors. As might be anticipated, an important element in such formulas is the number of cases in the sample. Other things being equal, the larger the sample the more stable the results. Another relevant factor is the extent of individual differences within each sample. If all men were of identical height, for example, and all women were likewise equal in

height, then sex differences could be conclusively established by comparing only one representative of each sex. All other samplings would yield the same difference, since variation within each sex would be zero. The greater the variability within each group, the larger will be the sampling error of the obtained difference.

For our present purposes, we are concerned, not with the computation of statistical significance, but with its interpretation.¹ Suppose that a group of boys average 8 points higher than a group of girls on a mechanical comprehension test. To evaluate the significance of this difference, the investigator finds what is known as a *t* ratio. By reference to a table of *t*, he can look up the probability that a difference as large as or larger than the obtained difference of 8 points in favor of either group could have resulted by chance.² Suppose he finds that this probability (*P* value) is 1 out of 100 ($P = .01$). This means that if there were actually no sex difference in mechanical comprehension in the entire population and if we were to draw 100 random samples of boys and girls from that population, only once would we find a mean difference as large as 8. We therefore say that the obtained sex difference is "significant at the .01 level." This statement is an expression of the confidence we can place in our conclusion. Thus if the investigator concludes that his results demonstrate a sex difference, his chances of being wrong are only 1 out of 100. Conversely, of course, we can say his chances of being right are 99 out of 100. Another frequently reported significance level is .05. This means that there are 5 chances out of 100 of being in error and 95 chances out of 100 of being correct.

In actual practice, the *P* value need not—and rarely does—fall exactly on the specified point, such as .01 or .05. If the investigator chooses the .01 level of significance, it means that he is willing to draw a conclusion when the probability of its being wrong is *one or less* out of 100. Hence it is customary to report the *P* value in the form of

¹ An explanation of the necessary statistical procedures can be found in any recent textbook on psychological statistics (see, e.g., Guilford, 1965, Chs. 8, 9).

² With very large samples, the measure employed is known as a critical ratio or normal curve ratio. The final interpretation of the probability values, however, is the same regardless of how they were derived.

$P < .01$ (or $P < .05$). This may be read: the chances that the conclusion is in error are less than 1 out of 100 (or less than 5 out of 100).

SELECTIVE FACTORS

Measures of statistical significance pertain only to chance errors. Their application presupposes the use of random samples. Under certain conditions, however, systematic errors of selection may operate to produce a biased or unrepresentative sample. Results obtained with such a selected sample cannot be generalized to the total population. An additional complication arises when two populations are compared, since selection may have operated differently in the two groups. Thus one group may represent a superior sampling of its population, while the other represents a mediocre or inferior sampling of the second population.

Immigrant groups furnish a good example of the differential operation of selective factors. Immigrants coming to the United States from different countries, for example, are usually neither fair samplings of their home populations, nor comparable among themselves. If it could be shown that immigrants from all nations were drawn consistently from, let us say, the lower socioeconomic or educational levels, then such groups would at least be comparable with each other. Because of political, social, economic, and other local conditions, however, immigrants coming from certain nations at a given time may represent a relatively inferior sampling of their population, from others a more nearly random or average sampling, and from still others a relatively superior sampling.

Other examples can be found in studies of *sex differences* (see Anastasi, 1958, Ch. 14). It might be assumed, for example, that high school senior boys and girls attending the same classes would constitute comparable samples of their sexes. But this is not the case. Boys whose school achievement is unsatisfactory are more likely than girls to leave school and go to work. Such selective dropping out is borne out by the ratio of boys to girls in successive years of high school, as well as by the grade records of those who drop out. The result is that the boys who remain in school represent a more highly selected sample, in terms of scholastic aptitude, than do the girls. Because of this differential selection, high school senior boys as a group excel on the same types of intelligence

tests on which girls excel in the lower school grades. This reversal of sex differences results from the cumulative effects of selective dropping out over the years.

The operation of differential selection is also illustrated by surveys of institutions for mental defectives. These surveys generally show an excess of males, a finding that was at one time cited as evidence for a sex difference in variability. It was argued that, although the average ability of men and women may be equal, the range of intelligence is wider among men. According to this doctrine, there should be more geniuses as well as more mental defectives among men than among women.

Subsequent investigations, however, revealed that the discrepancy results from social and cultural factors that operate differently in the admission of men and women to institutions. Unless a woman exhibits a pronounced degree of mental defect, she tends to be kept at home, or she may earn her livelihood by turning to such activities as housework, prostitution, or marriage. The boy, on the other hand, is forced into industrial work at a relatively early age and will soon reveal his mental deficiency in the competition he encounters. Thus, although there is an excess of males in institutions for mental defectives, it seems that there are more mentally defective females outside of institutions.

OVERLAPPING OF DISTRIBUTIONS

When Samuel Johnson was asked which is more intelligent, man or woman, he is reported to have replied, "Which man, which woman?" This remark highlights an important fact about *all* group comparisons, namely, the wide individual differences existing within each group, with the resulting overlapping between groups. Even when one group excels another by a large and significant amount, individuals can be found in the low-scoring group who surpass individuals in the high-scoring group. Because of the magnitude of individual differences within any one group, as contrasted with the relatively small differences between group averages, an individual's group membership is a very unreliable basis for predicting his standing in most psychological traits.

In published reports of group comparisons, averages are often supplemented with some index

of overlapping, such as the percentage of persons in one group who reach or exceed the median of the other group. In interpreting these percentages we must bear in mind that when two distributions coincide and overlapping is complete, 50 per cent of one group reach or exceed the median of the other. This follows from the fact that within any single group 50 per cent of the cases fall at or above their own median. Percentage of overlap must therefore be evaluated against 50, rather than 100, as the possible upper limit. It should also be noted that overlapping is reported with reference to the median, not with reference to the lowest score. Hence even if zero per cent of group A reaches or exceeds the median of group B, there will still be some individuals in group A who score as well as or better than certain individuals in group B. This situation is illustrated in the upper part of Fig. 9-1, in which the shaded portion shows the proportion of persons in the two groups who obtain the same scores.

In reality, the overlapping of groups is rarely if ever so slight that zero per cent of the lower group reaches or exceeds the median of the upper. A more nearly typical relationship is shown in the lower part of Fig. 9-1, in which 30 per cent of

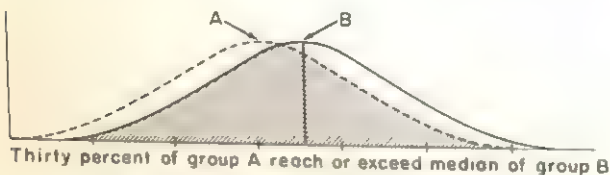
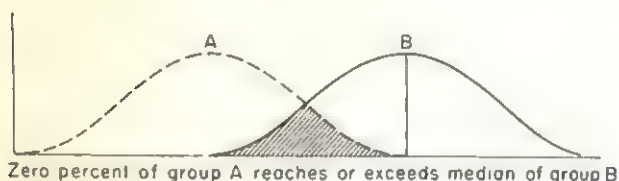


Fig. 9-1 Overlapping of distributions.

group A reach or exceed the median of group B. In this graph, the overlapping is again indicated by the shaded area. One implication of this degree of overlap is that if a member of group A is chosen at random, the chances are 30 out of 100 that his score will reach or exceed the median of group B. Let us suppose that distributions A and B represent the scores obtained on a problem-solving test by boys and girls, respectively. Let

us further suppose that, because of the large and significant mean difference between the groups, we assume that an individual girl is inferior to the boys' median in problem solving. Under these conditions, the chances of our being in error would be 30 out of 100. Such an error risk may be compared with the previously discussed .01 level usually required before accepting a conclusion in scientific research. In that case, the chances of being in error are only 1 out of 100. It is thus evident that, owing to the extensive overlapping of distributions, a knowledge of the individual's group membership does not permit the prediction of his relative standing at an acceptable probability level.

Another noteworthy point pertains to the total amount of overlapping shown in the lower part of Fig. 9-1. If 30 per cent of the girls reach or exceed the boys' median, the percentage of girls who reach or exceed the lowest boy's score will be approximately 99. Under these conditions, therefore, the ranges of the boys and girls will overlap almost completely, as can be seen in the graph. It is thus likely that the best performers of both sexes obtain about equally high scores, and that the poorest performers of both sexes score about equally low.

SUMMARY

In the light of the problems discussed in this section, it is apparent that three important questions to ask in evaluating the findings of any group comparison are:

- (1) Is the mean difference between the groups statistically significant?
- (2) Were the groups representative and comparable samples of their respective populations?
- (3) How far did the groups overlap?

If the answers to the first two questions are satisfactory and if the conclusion has been duly qualified in terms of the third question, there remains a very fundamental question, namely, "What caused the group difference?" It is to this question that we shall turn in the next section.

ORIGINS OF GROUP DIFFERENCES

In evaluating any study of group differences, we must differentiate between description and explanation. There is a mass of descriptive data

showing significant sex and race differences in performance on many types of psychological tests (see Anastasi, 1958, Chs. 14, 16, 17; Dreger & Miller, 1960; Shuey, 1958; Tyler, 1965, Chs. 10, 12). We cannot conclude, however, that these differences result directly and inevitably from the hereditary biological characteristics of sex or race. Insofar as cultural differences also characterize sex and racial groups, cultural factors may account for the obtained differences in test results. We thus need to look into the types of cultural influences that act differentially upon the two sexes, different races, and other major human groupings. And we need to examine the specific ways in which cultural and biological factors interact in the development of behavioral differences among these groups.

CULTURAL FACTORS

Although living in the same homes, boys and girls in most societies are reared in different subcultures. In countless ways, they receive differential treatment from parents, other adults, and playmates. They are dressed differently, given different toys, taught different games, and expected to behave differently in many situations of daily life. The personalities of mother and father are themselves important factors in the child's developing concept of sex roles, providing models of what is expected of each sex in the particular culture. Until quite recently, available opportunities for schooling differed for the two sexes, especially at higher educational levels. Even now, insofar as boys and girls may attend separate schools, it is likely that there are differences in curricular content, teaching methods, and emphases on different subjects for the two sexes. Although today women have entered nearly all vocational fields, there are still conspicuous differences in their relative acceptance and opportunities for advancement in several occupations. Ultimate vocational goals undoubtedly influence the individual's general life orientation, attitudes, motivation, and interests. These factors may in turn affect the development of abilities along different lines.

In comparative studies of national and racial groups, cultural differences assume major proportions. When tests developed within one culture are applied to members of a different culture, the latter are generally handicapped. Each test reflects the knowledge, skills, and attitudes fos-

tered within its own culture. Even when language and information specific to one culture are eliminated, much remains that is culture-bound. Persons reared in different cultures may differ in the importance they place upon speed, the strength of their achievement and competitive drives, their interest in solving abstract problems, and many other work habits and test-taking attitudes that affect performance.

Comparisons among national and racial minority groups living in the same country are complicated by differences in socioeconomic level, in amount and quality of education, and in other experiential factors. In comparative studies of Negroes and whites in America, for example, few investigators have controlled both socioeconomic and educational variables in the same groups. Even when such control was attempted, the matching was crude and superficial, thus leaving considerable leeway for cultural inequalities between the groups (see Anastasi, 1958, Ch. 16). For example, if Negro and white children are classified according to father's occupation into such classes as professional, business, clerical, skilled labor, and unskilled labor, it is likely that more Negroes than whites fall near the bottom of each of these broad categories. Even if specific occupations were to be matched, we could not assume that socioeconomic differences had been ruled out. The homes of an average Negro doctor and an average white doctor, for instance, probably differ in income level and in many other characteristics.

Besides these obvious environmental inequalities, there remains the important influence of social expectancy and racial stereotypes. What is expected of an individual tends to affect what he does and what he becomes. When such expectation carries the force of cultural tradition behind it and is repeatedly corroborated in daily interpersonal contacts, it is difficult not to succumb to it. As a result, the individual often becomes convinced that he is intellectually inferior or superior, or that he possesses this or that talent or defect according to the dictates of the particular culture.

In the effort to cut through cultural factors in test performance, psychologists have developed a number of so-called "culture-free" tests (see Anastasi, 1961, Ch. 10). Although useful in particular testing situations, these tests do not pro-

vide a general solution for the problem of cross-cultural comparisons. In the first place, the term "culture-free" is a misnomer, since no test can be constructed in a cultural vacuum. It is theoretically possible to devise a test that presupposes only experiences that are common to different cultures. Although not *free* from cultural influences, such a test would utilize only elements *common* to all cultures. This is what culture-free tests have tried to achieve.

In actual practice, however, culture-free tests fall short of this objective in many ways. No available test is entirely unrestricted in its cultural reference. The difference between traditional and culture-free tests is one of degree. The latter still favor some cultures over others with respect to knowledge, intellectual skills, work habits, attitudes, and other relevant aspects of behavior. Furthermore, if it should prove possible to construct a test out of truly common elements, such that it would be equally "fair" in all cultures, the functions measured might prove to be quite trivial. Such a test might have little validity in terms of significant criteria within any single culture and might be quite unrelated to intelligence as conceived within any culture. Attempts to remove cultural influences from tests fail to come to grips with the role of culture in group differences. It is only the more superficial cultural influences that can be ruled out through the redesign of tests. As we shall see in the next section, however, cultural differentials operate also at more basic levels.

LEVELS OF CULTURAL DIFFERENTIALS

All behavior is affected by cultural factors. Insofar as every psychological test measures a sample of the individual's behavior, it too will reflect cultural differences. In interpreting test scores, however, we must bear in mind that cultural factors may influence behavior at many levels. At one extreme, they may produce superficial, trivial differences that are limited to the test itself and have no broader implications. Thus an intelligence test may require an interpretation of the proverb, "A stitch in time saves nine." If the subject was reared in a culture in which this proverb is unknown—and especially one in which mending is not a common practice—he may fail the item. This failure, however, would tell us little or nothing about the subject's abilities in handling other situa-

tions, or even his performance in other parts of the test. Such a cultural handicap is narrowly circumscribed and specific to the particular test.

Most cultural differentials, however, have broader effects that extend beyond test performance. If a Puerto Rican child scores poorly on an intelligence test because of language handicap, the same handicap will interfere with his school learning and may consequently retard his general intellectual development. The effect is obviously broader in this case than it was in the first example, but it can still be remedied by special language training. As a third example, let us suppose that a junior high school student receives a low score on an intelligence test because he was reared in a disadvantaged environment. His home provided inadequate intellectual stimulation and little incentive for succeeding in school. Parental attitudes were such as to discourage language development and exploratory, problem-solving behavior. For this student, the cultural handicap extends far beyond test performance and represents a pervasive long-lasting influence. His intellectual and motivational deficiencies may still be overcome through remedial educational programs, counseling, or even psychotherapy. But if the effects are too deep-rooted, the handicap may not yield to remedial measures at this stage.

Finally, at the most basic level, cultural differentials may produce organic defects that in turn lead to intellectual or emotional disorders. Such effects are illustrated by medical complications of childbearing and birth occurring in different groups (Pasamanick, Knoblock, & Lilienfeld, 1956). A series of studies of large samples of Negroes and whites in Baltimore demonstrated that irregularities of pregnancy and childbirth are significantly related to mental defects and behavior disorders in the offspring. An important source of these irregularities is to be found in deficiencies of maternal nutrition, inadequate medical care, and other conditions associated with low socioeconomic status. Analysis of the data revealed a much higher incidence of all such disorders of pregnancy and parturition in lower than in higher socioeconomic levels, and a higher incidence among Negroes than among whites. Here then is an example of cultural differentials producing organic deficiencies that in turn lead to behavioral inadequacies or disorders. The effects of this sort of cultural differential cannot be reversed within

the individual's lifetime, but require more than one generation for their elimination. Merely because a condition has a cultural origin does not mean that it is trivial and superficial, nor that "it will go away if we just ignore it." Conversely, neither the permanence nor the organic basis of a psychological deficiency implies hereditary origin. Nor does the existence of such deficiencies justify a failure to correct the very environmental conditions that brought them about.

SEX DIFFERENCES

APTITUDES

At a purely descriptive level, significant mean differences between men and women in our present culture have been established in several aptitudes (see Anastasi, 1958, Ch. 14; Terman & Tyler, 1954; Tyler, 1965, Cr. 10). Males as a group excel in speed and coordination of gross bodily movements, spatial orientation, mechanical comprehension, and arithmetic reasoning. Females excel in manual dexterity, perceptual speed and accuracy, memory, numerical computation, verbal fluency, and other tasks involving the mechanics of language. Many of these sex differences are manifested from infancy or early childhood. For example, observations of preschool children (Gesell *et al.*, 1940) show that boys are faster and make fewer errors than girls in walking a series of narrow boards, and also achieve more accuracy and distance in throwing a ball. Girls, on the other hand, show superior control of finger and wrist movements in such tasks as dressing, buttoning, tying a bowknot, washing hands, and turning door knobs.

That adult women carry out many manipulatory activities more quickly and accurately than men has been widely recognized in industry. This fact was especially apparent during World War II, when women were often assigned to assembly, inspection, and similar industrial operations. Such observations are corroborated by performance on aptitude tests in which small objects must be placed or assembled with fingers or tweezers. Also of vocational significance is women's superiority in perceptual speed and accuracy in tasks requiring rapid shifting of attention. These are the principal functions measured by clerical aptitude tests, in which women make a consistently better

showing than men at all ages (Andrew & Paterson, 1959; Schneider & Paterson, 1942).

Sex differences in language development also appear early in life (McCarthy, 1954). On the average, girls begin to talk earlier than boys; and during the preschool years they use a larger vocabulary and more mature sentence structure than do boys. Girls also make more rapid progress in learning to read. On most verbal tests, girls surpass boys during the elementary school period. At the high school and college levels, however, females excel only in the more mechanical aspects of language, as illustrated by word fluency, spelling, and grammatical usage. Tests of verbal comprehension and verbal reasoning show either no sex difference or small differences in favor of boys (Anastasi, 1958, Ch. 14; Wesman, 1949).

On tests of spatial and mechanical aptitudes, males excel by large and significant amounts. This sex difference, however, does not appear until late childhood. Among preschool children, no sex difference has been noted in such tasks as block-building, fitting differently shaped pieces into formboards, and recognizing shapes (Gesell *et al.*, 1940). At the elementary school level, boys are clearly superior on tests involving formboards, puzzle boxes, mazes, directional orientation, and estimating the number of blocks in piles (see Anastasi, 1958, Ch. 14). The differences in favor of males are larger in tests calling for mechanical information than in the more abstract tests of spatial visualization. Figure 9-2 shows the distributions of 10th-grade boys and girls on the Mechanical Reasoning Test of the Differential Aptitude Tests (Bennett, Seashore, & Wesman, 1963). Although this test yields one of the largest sex differences obtained in the measurement of aptitudes, it is interesting to note the extensive overlapping of the two distributions.

A highly consistent sex difference has been found in spatial orientation (Witkin *et al.*, 1954). When visual and bodily cues conflict, as in experiments with a tilting chair within a tilting room, women tend to rely more on visual cues, men more on bodily cues. As a result, women make larger errors than men in judging their own bodily position. Women also perform more poorly on tests in which visual stimuli must be judged independently of their surroundings, as when the position of a rod must be determined independently of the position of the frame around it, or

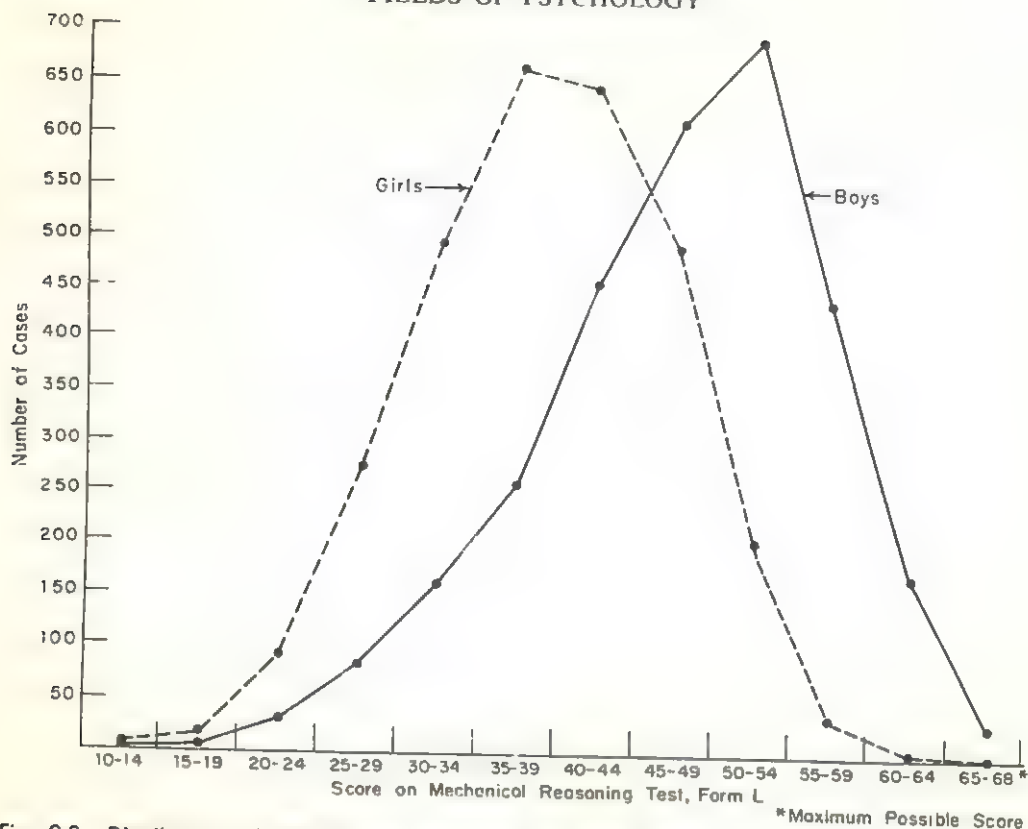


Fig. 9-2 Distribution of 2936 10th-grade boys and 2925 10th-grade girls on the Mechanical Reasoning Test of the Differential Aptitude Tests. (Data by courtesy of the Psychological Corporation.)

when a simple geometric figure must be identified within a more complex design. In all these situations, women tend to be more often misled by the surrounding visual field.

In the numerical area, sex differences again fail to appear until children are well along in the elementary school period (Anastasi, 1958; Terman & Tyler, 1954). From that stage on, girls tend to perform better than boys on computation tests. In the solution of arithmetic problems and on other numerical reasoning tests, on the other hand, boys excel consistently. There is also some evidence that males are superior in problem solving generally, especially when the problem requires a change in approach and a reorganization of facts in new ways (Sweeney, 1953). Of particular interest is the finding that performance in problem solving is related to sex differences in attitudes toward problem solving (Carey, 1958) and to the degree of sex-role identification (Milton, 1957). Within each sex, closer identification with the masculine sex role, as indicated on a person-

ality inventory, was found to be associated with superior problem-solving skill. These findings open up interesting possibilities regarding the part that sex differences in attitudes may play in the development of aptitudes.

PERSONALITY

Among the principal personality differences found between the sexes are the greater aggressiveness, achievement drive, and emotional stability of the male and the stronger social orientation of the female (Anastasi, 1958, Ch. 14; Bennett & Cohen, 1959; Terman & Tyler, 1954). Sex differences in *aggression* are manifested from early childhood. Investigations of nursery and preschool children utilizing teachers' reports, direct observation of spontaneous activities, or psychological tests have repeatedly shown that boys manifest more anger, aggression, destructiveness, and quarrelsome behavior than do girls. This sex difference may also help to explain the much higher incidence of behavior problems

among boys than among girls of school age. In standardized self-report inventories administered to high school, college, and miscellaneous adult samples, males score significantly higher than females on both aggression and dominance scales (Edwards, 1959; Gordon, 1953; Guilford & Zimmerman, 1949).

There is evidence from a variety of sources pointing to sex differences in *achievement motivation*. In our culture, males exhibit a stronger drive to achieve and to advance than do females. Data in support of this difference are provided by vocational choices of high school students, personality inventory responses, performance on projective tests of personality, and results of specially designed experiments on level of aspiration (Anastasi, 1958, Ch. 14; Edwards, 1959).

Another area in which large sex differences have been found is that of *emotional adjustment*. At the preschool and elementary school levels, girls report more fears and worries than do boys and also manifest more so-called nervous habits, such as nail-biting and thumb-sucking. Behavior problems, on the other hand, are more common among boys. The total amount of maladjustment or instability may thus be no different in the two sexes at these age levels. Girls may simply develop less overt or less aggressive symptoms of maladjustment than boys, owing to differences in sex roles and socially imposed restrictions (Macfarlane, Allen, & Honzik, 1954; Terman & Tyler, 1954). On personality inventories, clear-cut sex differences in emotional instability do not appear until adolescence. Among adults, large and significant differences on adjustment inventories have been found, women as a group reporting more evidence of maladjustment (Gordon, 1953; Guilford & Zimmerman, 1949).

Many sex differences in interests, attitudes, and interpersonal relations center on the greater *social orientation* of women (Johnson & Terman, 1940; Terman & Tyler, 1954). This sex difference appears early in life and continues into old age. Throughout childhood, sex differences in social orientation have been observed in a variety of ways. In the play activities of nursery school children, for example, boys show more concern with things, girls with personal relationships. At all ages, girls engage more often in "social" games involving cooperative activities with other children; they read more books about people and more

often express an interest in occupations dealing with people. Parents' records of the questions children ask show that girls ask a significantly larger proportion of questions about social relations than do boys. Girls' wishes, fears, daydreams, and pleasant and unpleasant memories more often concern people. Even studies of children's dreams have indicated that girls more often than boys dream about people in general, as well as about their own family.

Surveys of adults by means of personality inventories reveal similar sex differences. Women report more social interests, concern about social welfare, loyalty to group and friends, tendency to analyze the motives of oneself and others, desire to do what is expected, willingness to accept blame and to give in to others, need for sympathy, and readiness to help others (Allport, Vernon, & Lindzey, 1960; Edwards, 1959). Figure 9-3 shows the distribution of a large national sample of men and women on the Affiliation Need as measured by the Edwards Personal Preference Schedule (Edwards, 1959). Described as the need to be loyal, to participate in friendly groups, and to share and do things with friends, Affiliation yielded one of the largest mean differences between men and women on this test.

INTERACTION OF BIOLOGICAL AND CULTURAL FACTORS

In the development of both aptitudes and personality traits, cultural influences interact with biological differences between the sexes. The different roles men and women play in the reproductive function undoubtedly contribute to sex differentiation in psychological development. Thus the long period of child-bearing and child-rearing, which falls biologically upon the female partner, has far-reaching implications for sex differences in interests, attitudes, emotional traits, vocational goals, and achievement.

Sex differences in aggressiveness and dominance are associated with the greater body size, strength, and physical endurance of the male, as well as with the presence of male sex hormones. In this connection, it should be noted that greater male aggressiveness has been observed in animal as well as in human behavior. Fighting, restlessness, and resistance to control have been commonly reported as more characteristic of male than of female animals. That this difference is probably re-

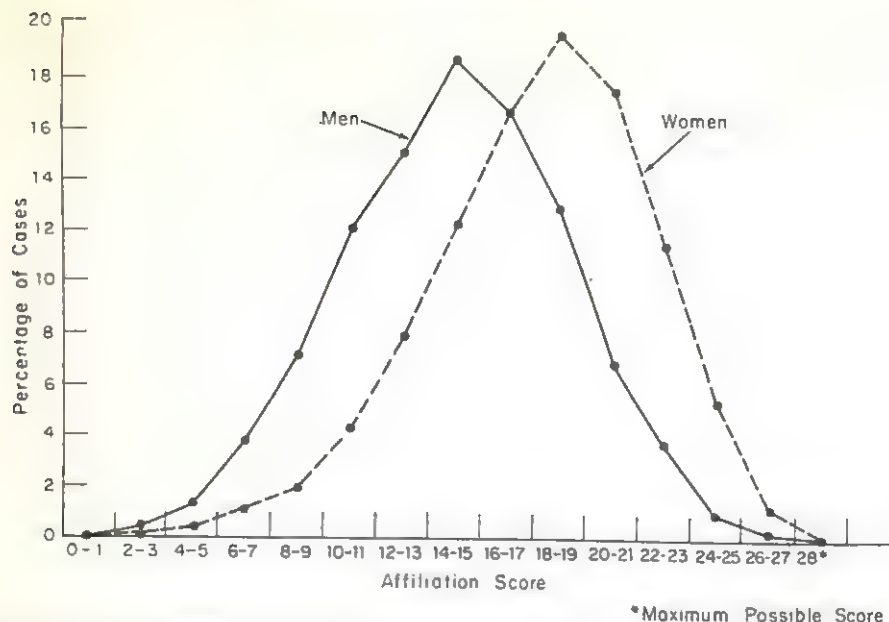


Fig. 9-3 Percentage distribution of 4031 men and 4932 women on Affiliation Need as measured by the Edwards Personal Preference Schedule. (Data by courtesy of Dr. Arthur Kaponen and the Psychological Corporation.)

lated to the presence of male sex hormones is indicated by experiments involving the removal of gonads, as well as the injection of sex hormones.

Another significant sex difference is to be found in the developmental acceleration of girls. Not only do girls reach puberty earlier than boys, but throughout childhood they are also farther advanced toward their own adult status in all physical traits. The psychological effects of this sex difference in developmental rate probably vary widely from trait to trait. In infancy, the developmental acceleration of girls may be an important factor in their more rapid acquisition of language and may give them a head start in verbal development as a whole. Another possible implication of girls' developmental acceleration is a social one. Because of their physical acceleration, girls tend to associate with boys older than themselves. This tendency probably accounts also for the usual age discrepancy between husbands and wives. Since the girl is younger than the boys with whom she associates socially—and younger than the man she marries—she is likely to be surpassed by most of her male associates in education, intellectual level, and general experience. Such a situation may be at the root of many social attitudes toward the two sexes. A younger person is likely to have less wisdom, knowledge,

and sense of responsibility than an older one, and such an age difference may have been traditionally perceived as a sex difference.

Still another biological difference between the sexes pertains to the greater viability of the female, or the higher death rate of males at all ages, from the prenatal period on. We could speculate at length regarding the possible social implications and indirect psychological effects of this difference. One consequence is an excess of women, which increases with age. This condition obviously influences the relative opportunity of men and women for marriage. A proportional scarcity of males makes marriage more competitive for the female than for the male and may in turn affect the attitudes of men and women toward marriage.

The few examples cited will suffice to illustrate the varied and intricate mechanisms whereby biological differences between the sexes may lead to the development of differences in aptitudes, interests, and other psychological traits. It is evident that at all developmental stages biological differences are intertwined with cultural differences. That sex roles and sex stereotypes may vary in different cultures has been repeatedly demonstrated (see Anastasi, 1958, Ch. 14). To be sure, a few persistent behavioral differences can be identified. These undoubtedly result from major

biological differences. Thus the widespread prevalence of male dominance in different cultures is probably related to sex differences in physique and strength, as well as to sex hormones. But the degree of such a sex difference in dominance, as well as the manner in which it is expressed, varies widely from culture to culture.

SOCIOECONOMIC CLASSES

SOCIAL STRATIFICATION

Sociologists have investigated the class structure of American society by the same sort of procedures employed by anthropologists in their field studies of simpler cultures. Essentially, the investigator lives for an extended period of time in the community chosen for study, participates in its activities, and interviews key members of the community (Warner & Lunt, 1941). Through such observational techniques, he discovers who associates with whom and in what capacities (e.g., business relations, community projects, recreational activities, etc.). It is largely through the nature and extent of these interpersonal contacts among community members that social classes are defined and that individuals are classified as members of social classes.

By these methods, sociologists have identified six major classes in contemporary American society, designated as upper-upper, lower-upper, upper-middle, lower-middle, upper-lower, and lower-lower (see Anastasi, 1958, Ch. 15; Warner & Lunt, 1941). The proportion of persons falling into each of these classes does not vary substantially among the communities investigated in different parts of the country. The distinction between upper-upper and lower-upper in the New England and southern communities studied was based chiefly upon family background. The upper-uppers represented the "old aristocracy" and the lower-uppers the "newly rich." In the midwestern communities, this differentiation was generally absent, there being only one upper class comprising the wealthiest and most prominent families. The upper-middle class consisted principally of business and professional persons (the "pillars of society"), while the lower-middle class included small tradesmen, white-collar workers, and some skilled laborers. The upper-lowers, comprising largely semi-skilled and unskilled workers, were

often described by middle-class persons as "poor but respectable" and "hardworking people." In contrast, the lower-lowers were characterized as shiftless and disorderly. The lower-middle and upper-lower classes, which together include over 60 per cent of the population, are sometimes described as the "core culture."

Since field study by participant observers is laborious and time-consuming, simpler procedures have been developed that give a close approximation of the results of the earlier method. One of these simplified techniques provides an Index of Status Characteristics for each individual (Warner, Meeker, & Eells, 1949). This index is computed by rating the individual on a seven-point scale in each of four factors, namely, occupation, source of income, house type, and dwelling area, and then finding a weighted sum of the four ratings. Approaching the problem from somewhat different angles, psychologists have contributed indices based on a factorial analysis of census characteristics of different neighborhoods (Tryon, 1955) and an index showing the individual's own class identification (Sims, 1952). In all the indices developed, occupational level receives a relatively large weight and provides a fairly close approximation of the various indices. Hence the large body of available data on the relation of occupational level to intellectual and personality traits can be fitted into the class structure delineated by sociological research.

CHILD-REARING PRACTICES

The differential psychologist is particularly interested in the effects that social class membership may have upon the individual's emotional and intellectual development. Although social mobility is common and class distinctions are not sharp in our society, social classes nevertheless represent distinct subcultures. The nature and extent of social interaction between members of different classes is limited. Moreover, class stratification is associated with conspicuous differences in home life, education, recreational outlets, and community activities.

Several investigators have placed considerable emphasis upon class differences in child-rearing practices and upon the possible implications of such differences for psychological development. Studies of child-rearing practices conducted over

two decades have revealed certain significant differences between middle-class and lower-class homes. Although he may be physically more restricted and more rigidly reared with regard to weaning, toilet training, and other infant-rearing practices, the middle-class child enjoys more freedom to communicate with both parents and experiences less fear of parents and less parental rejection than does the lower-class child (Bayley & Schaefer, 1960; Davis & Havighurst, 1946; Himmelweit, 1956; Maas, 1951; Milner, 1951; Sears, Maccoby, & Levin, 1957). What earlier studies had interpreted as the greater freedom of the lower-class child was usually evidence of parental neglect and was accompanied by a number of psychologically undesirable child-rearing practices and attitudes.

Certain aspects of lower-class family life and parental attitudes are such as to undermine the child's self-confidence and emotional security and to discourage intellectual development. The operation of these factors was illustrated in a study of first-grade school children (Milner, 1951). First, a close correspondence was found between the previously described Index of Status Characteristics and the reading readiness and language development of the children upon school entrance. Two subgroups of high and low language scorers were then selected for intensive study through interviews of the children and of their mothers. The results revealed a number of sharp differences between the two subgroups, which also differed in socioeconomic level. The investigator summed up the differences in terms of two advantages of the middle-class child as compared with the lower-class child. The first was described as "a warm, positive family atmosphere or adult-relationship pattern which is more and more being recognized as a motivational prerequisite for any kind of adult-controlled learning." The lower-class children tended to perceive adults as predominantly hostile. The second advantage was "an extensive opportunity to interact verbally with adults of high personal value to the child who possess adequate speech patterns." The latter point is illustrated by a radically different atmosphere around the meal table. In the homes of the high language scorers, there was more spontaneous mealtime conversation between adults and children. In contrast, the parents of the low scorers tended to prohibit or discourage conversation by children during meals. There is ample evidence from other

research with both preschool and school-age children indicating a close relationship between language development and socioeconomic level (McCarthy, 1954; Templin, 1957). The above study throws some light on possible causal mechanisms underlying this relationship.

Class differences in home background and parental attitudes are reflected in the generally poorer school achievement and educational progress of lower-class children. Nor can these educational differences be explained simply on the basis of intellectual level. In one survey of pupils with IQ's of 110 or higher, conducted in the 1930's, subgroups of lower and higher socioeconomic status were compared (see Warner, Havighurst, & Loeb, 1944, pp. 51ff). In the higher social group, 93 per cent graduated from high school and 57 per cent attended college; in the lower, 72 per cent graduated from high school and 13 per cent attended college. With the rapid expansion of scholarship programs in recent years, these discrepancies have undoubtedly been reduced. Nevertheless there is evidence that class differences in attitude toward education are an important differentiating factor (Havighurst & Taba, 1949; Himmelweit, 1955; Hollingshead, 1949; Hollingshead, 1952; Stendler, 1951). Studies of both the children themselves and their parents show that middle-class children are taught to respond more favorably to the competitive situations represented by schoolwork and intelligence tests than are lower-class children; and that they are more strongly motivated for personal achievement and academic advancement. The expectations and attitudes of teachers and school administrators, who are themselves usually identified with the middle class, may also contribute to the superior scholastic attainments of middle-class children (Hollingshead, 1949).

OCCUPATIONAL LEVEL AND INTELLIGENCE

There is a large body of data showing a positive relation between occupational level and intelligence test performance. Analyses of scores obtained by American soldiers on the Army Alpha during World War I and on the Army General Classification Test during World War II provide large-scale corroboration of this relationship. Illustrative data on fifteen occupations, selected from different levels of the occupational hierarchy, are reproduced in Fig. 9-4. Similar differences have been

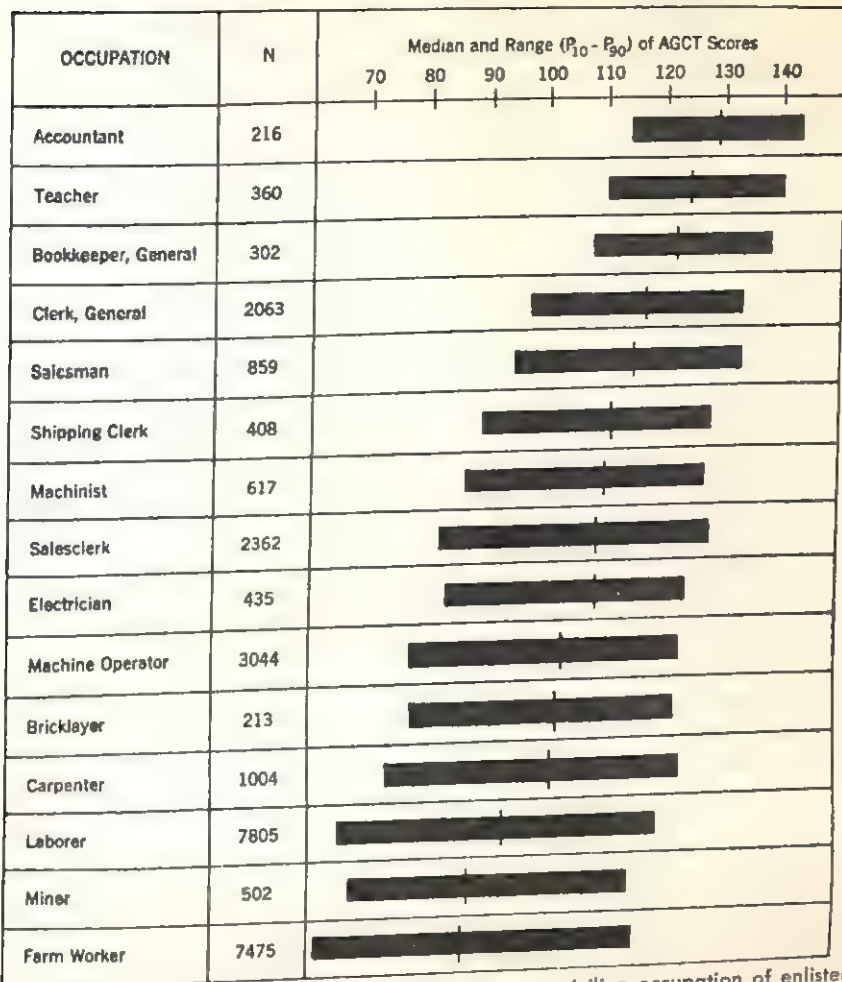


Fig. 9-4 Army General Classification Test scores in relation to civilian occupation of enlisted men in World War II. (From Anastasi, 1958, p. 516, by permission of The Macmillan Company; data from Stewart, 1947, pp. 5-13.)

found when large, representative civilian or military samples were examined with different types of intelligence tests, both in the United States and in European countries (Carlsson, 1955; Foulds & Raven, 1948; Miner, 1956; Simon & Leviitt, 1950).

That the relationship between occupational level and intelligence test performance cannot be attributed predominantly to differences in vocational experiences and amount of formal schooling is demonstrated by the occurrence of similar differences when children are classified according to father's occupation. More general background differences are evidently involved, which characterize not only men in different occupations but also their families. On such tests as the Stanford-Binet (McNemar, 1942) and the Wechsler Intelligence Scale for Children (Seashore, Wesman,

& Doppelt, 1950), the IQ's of children in the professional class average about 20 points higher than those of children in the unskilled labor class. Similar findings have been obtained in a large number of studies, extending from the preschool to the college level (see Anastasi, 1958, Ch. 15).

The superiority of persons in higher occupational levels, however, varies with the nature of the tests, tending to be larger in verbal and smaller in mechanical and spatial aptitude tests (Anastasi, 1958, Ch. 15). It is interesting to note that similar relationships have been found in comparisons of urban and rural groups (Anastasi, 1958, Ch. 15). Not only do urban groups excel rural groups on most intelligence tests, but these differences, too, are larger in verbal than in mechanical and spatial functions. To some extent,

the obtained differences may reflect the social class membership of test constructors, which may affect test content. Standardization samples, moreover, are composed predominantly of urban residents. One investigator undertook to test the influence of the latter condition by developing two forms of a test, one on an urban and one on a rural population (Shimberg, 1929). When both forms were administered to new samples of urban and rural children, the former excelled significantly on the urban form, the latter on the rural form.

PERSONALITY DIFFERENCES

Research with both adults and children has revealed a number of socioeconomic differences in personality characteristics (Auld, 1952; Anastasi, 1958, Ch. 15). On personality inventories, lower-class persons tend to report more neuroticism, emotional insecurity, irritability, and worries and to obtain lower scores in self-sufficiency, dominance, and social maturity than do middle-class persons. Many of these social class differences in personality have been incorporated in a "status scale" developed by Gough (1948) on the basis of the personality test responses of two groups of high school students representing contrasting socioeconomic levels. Attitude surveys show higher socioeconomic level to be associated with more conservative attitudes, and lower socioeconomic level with more radical attitudes. In general, too, middle-class persons are more concerned with advancement along vocational and other lines, while lower-class persons emphasize security.

In their extensive interview surveys of sexual behavior, Kinsey and his associates (Kinsey *et al.*, 1948, 1953) likewise found large social-class differences, although these differences occurred principally among males. These investigators themselves regarded the socioeconomic differences as one of the major findings of their survey. In commenting upon such differences, they wrote:

The data now available show that patterns of sexual behavior may be strikingly different for different social levels that exist in the same city or town, and sometimes in immediately adjacent sections of a single community. The data show that divergencies in the sexual patterns of such social groups may be as great as those which anthropologists have found between the sexual patterns of different racial groups in remote parts of the world (Kinsey *et al.*, 1948, p. 329).

The incidence of psychoses and other psychiatric disorders is also closely related to socioeconomic status. The relative frequency of these disorders is much greater in lower than in higher occupational and income levels. Such results have been obtained, not only through analyses of hospital admissions, but also through intensive community studies and through surveys of all patients undergoing psychiatric treatment in public and private hospitals, outpatient clinics, and physician's offices (Hollingshead & Redlich, 1958; Scott, 1958; Srole *et al.*, 1962). It is thus apparent that every aspect of the individual's psychological development is related to socioeconomic characteristics of his background.

RACE AND CULTURE

GENETICS OF RACE

Race is a biological concept referring to subdivisions of a species. It corresponds to such categories as breed, stock, or strain in animals. Modern geneticists emphasize the *process* of race formation or diversification, as well as the reverse process of race mixture or hybridization, both of which are continually occurring (David & Snyder, 1951; Dobzhansky, 1950; Dobzhansky, 1962). They point out that the evidence is against the existence of distinctly differentiated "pure races" of man, either now or at any time in the past. Genetic differences among human races are not absolute but relative. Human races are interbreeding populations that differ in the relative frequency of certain genes. Any racial group will exhibit some internal variation in hereditary racial characteristics and will overlap with other populations in such characteristics. For example, blue eyes are much more frequent among Nordics than among Mediterraneans. Some Mediterraneans, however, have blue eyes, and some Nordics have brown eyes. Although the existence of such "non-conformists" in a population might result from migration or race mixture, geneticists now stress the fact that such cases are to be expected in the ordinary process of race formation. Their occurrence merely indicates that racial diversification, or the sorting out of genes into different populations, has not proceeded far enough to eliminate such variants. It is for this reason that

the concept of race can be meaningfully applied only to populations, not to individuals.

Races are formed whenever a group of persons becomes relatively isolated, for either geographic or social reasons, so that marriage among its members is more frequent than marriage with outsiders. Major geographical barriers such as the Sahara desert or the Himalayas have for centuries separated Europeans from Africans and Asiatics, a condition that has led to a relatively high degree of racial differentiation in these regions. In areas lacking such barriers, intermediate and transitional types are common. It should be noted that the very isolation that leads biologically to race formation also tends to foster cultural differentiation. Hence different racial groups are very likely to differ in their cultural environments as well. We can thus understand why it is so difficult to separate the influence of biological and cultural factors in the interpretation of psychological differences among such groups.

The number of racial categories into which mankind is classified is largely a matter of convenience, since all degrees of differences among populations may be identified. The racial differentiation between European whites and African Negroes is large; that between Norwegians and Spaniards is smaller; and that between the inhabitants of two French villages is still smaller. But regardless of its order of magnitude, the nature of the distinction is fundamentally the same, the examples cited representing different stages or degrees of race formation. How far down the scale we choose to apply the term "race" is an arbitrary decision. Hence it is not surprising to find wide variation in the numbers of races or subraces proposed by different writers. The anthropologist Kroeber (1948) classified mankind into three major races (Caucasian, Mongoloid, and Negroid), plus a "doubtful" category of small populations that were difficult to classify. Each of the three major races was further subdivided into three or four subraces. More recently, the geneticist Dobzhansky (1962, Ch. 10) has proposed a system of 34 races, including some racial mixtures that are currently emerging as identifiable genetic populations.

RACE MIXTURE

In the effort to disentangle the contributions of cultural and biological factors to group differences,

some psychologists have tested racially mixed groups. It was argued that, if one race is intellectually superior to another because of genetic factors, the hybrid offspring of both races should be intermediate in intelligence. Genetically, this hypothesis is questionable, since it assumes complete linkage between the genes determining skin color or other racial criteria and those determining intelligence. With incomplete linkage, any correlation between racial characteristics and intelligence would disappear within a few generations of cross-breeding.

Race mixture, moreover, is likely to be selective rather than random with regard to socioeconomic, educational, and other population characteristics within one or both races. Another difficulty in the way of interpretation arises from possible correspondences between the extent of race mixture and of cultural assimilation. The hybrid is likely to have had more contact with the dominant culture and tends to be accepted more readily into that culture.

The role of cultural factors in the relative test performance of hybrid groups can be illustrated by research with the American Indian. Early studies yielded correlations in the .40's between amount of white admixture, as determined by ancestry records, and scores on verbal group intelligence tests (Garth, Schuelke, & Abell, 1927; Hunter & Sommermier, 1922). The subjects of these studies, however, were drawn from many different tribes, varying in both amount of white mixture and, concurrently, in their familiarity with English and general assimilation of the white culture. That tribal differences in cultural assimilation, rather than race mixture, accounted for the correlation was later demonstrated by two types of findings. First, the correlation is highest on verbal and information tests, and disappears when nonverbal and performance tests are employed (Telford, 1938). Second, the correlation drops to zero on *both* verbal and nonverbal tests when comparisons are made within a single tribe that is relatively homogeneous in its degree of assimilation of the white culture (Klineberg, 1928; Rohrer, 1942).

RACE DIFFERENCES AND AGE

In the preceding chapter, we noted that children brought up in disadvantaged environments often show a decline in IQ with age. This age decrement has been observed in groups of chil-

children living in houseboats, gypsy camps, isolated mountain communities, and urban slums, among others. A similar age decrement has been found among American Negro children reared in underprivileged environments. The evidence comes chiefly from cross-sectional studies, although some longitudinal data are also available.

In investigations at the infant and preschool level, Negro-white differences in intelligence test performance are either highly reduced or completely nonexistent. Negro infants examined in New Haven with the Gesell Developmental Schedules did not differ significantly from the white norms (Knoblock & Pasamanick, 1953; Pasamanick, 1946). A follow-up of part of this group at an average age of about two years again revealed no retardation. A study conducted in the Chicago area with the Northwestern Infant Intelligence Tests and the Cattell Infant Intelligence Scale also found no significant differences between Negro and white infants (Gilliland, 1951). Negro kindergarten children tested in Minneapolis obtained a mean Stanford-Binet IQ of 100.78, which did not differ significantly from that of white children from comparable occupational levels in the same city (Brown, 1944). In a study conducted in New York City, five-year-old Negro and white children attending Department of Welfare Day Care Centers showed no significant IQ difference on the Goodenough Draw-a-Man Test (Anastasi & D'Angelo, 1952). In language development, as measured through an analysis of spontaneous speech samples, a number of significant differences favoring the whites were found in segregated neighborhoods, but only one significant difference in the same direction was found in integrated neighborhoods.

Comparisons of Negro and white school children on both intelligence and achievement tests have generally yielded significant differences in favor of whites, the differences increasing with age (Kennedy, Van de Riet, & White, 1963). This trend was corroborated in a longitudinal study, conducted in the South, in which the same groups of Negro and white children were reexamined with intelligence tests and with tests of reading and arithmetic in the sixth, eighth, and tenth grades (Osborne, 1960). On all three types of tests, mean differences between Negroes and whites increased progressively over this period. In all these studies showing age decrement, it

should be noted that absolute scores still improve with age. The decrement observed in such relative scores as the IQ simply means that the individual fails to improve as much with age as does the normative sample.

In the interpretation of the age decrements found in various underprivileged groups, several hypotheses have been proposed. One possible explanation is in terms of the cumulative effects of the deficient environment. As the child's intellectual needs expand with age, the inadequacies of his environment for meeting these needs increase progressively. Another factor that undoubtedly enters into the results obtained with some intelligence tests is the difference in functions measured by these tests at younger and older ages. The increasing emphasis upon verbal aptitudes and other abstract intellectual functions at the upper ages may represent a growing handicap for children reared in intellectually limited environments. From a broader viewpoint, we might say that age decrement in IQ occurs when a test depends primarily upon intellectual functions that are not fostered in a particular subculture. Whether the performance of a given group relative to the norms rises, declines, or remains constant may depend upon the relation between test content and the values promulgated by its culture (Levinson, 1961). This interpretation ties in with the previously discussed studies of urban and rural groups and with the general observation that any test favors the culture within which it was developed.

INTRARACIAL COMPARISONS

In analyzing the relative contribution of cultural and biological factors to racial differences in test performance, some investigators have utilized intraracial comparisons. They have asked: What differences are found between samples of the *same* race reared in different environments? And how does the difference between racial groups vary in different environments?

This approach is illustrated by an early study of American Indian, Negro, and white school boys in the United States (Klineberg, 1928). An abridged version of the Pintner-Paterson Performance Scale was administered to: two groups of Indian boys, one attending a year-round government boarding school and the other living on an Indian reservation; two groups of Negro boys, one in New York City and the other in a rural area in the South;

and three groups of white boys, one living in New York City and the other two in rural areas near those occupied by the southern Negroes and the reservation Indians. In number of errors made on the tests, the Indian boys as a whole excelled the whites, and the Negroes were about equal to the whites. Total IQ on this scale, however, depends to a considerable extent upon speed, and in all measures of speed the whites were superior. Further analyses of speed scores showed that in this respect intraracial differences between regions were larger than interracial differences in the same region. In speed of performance, the boarding school Indians clearly excelled the reservation Indians, and the New York City Negroes excelled the rural southern Negroes. Corresponding differences were found between New York City whites and the two rural white samples.

In explaining these findings, the investigator called attention to the relatively insignificant part that speed played in the life of the reservation Indian or the rural southern Negro. Time was of little or no concern in the daily activities of the Indian boys, who could see no reason for hurrying through a task, especially one they found enjoyable. Insofar as the examiner succeeded in arousing the subject's interest in the test, he made the need for speed appear even more incomprehensible. At the government school, on the other hand, time was much more important. The students were kept busy with a variety of tasks and the entire day was carefully scheduled. The white teachers, too, fostered the attitude that it is desirable to finish things as quickly as possible. Similarly, the New York City Negroes had been exposed to the hustle and bustle of life in a large metropolis, whereas the rural Negroes were adapted to a much slower tempo.

Within the American Negro population, differences in test performance between northern and southern samples are especially pronounced. The superiority of northern over southern Negroes has been repeatedly demonstrated in studies of school children, college students, and enlisted men in both world wars (see Anastasi, 1958, Ch. 17). These regional differences persist when comparisons are made between groups matched in occupational level.

Two hypotheses have been proposed to account for these regional differences. One attributes them to regional differences in educational facilities,

socioeconomic level, intergroup attitudes, and other cultural conditions. The other explains the differences in terms of selective migration, maintaining that the more intelligent and ambitious Negroes have tended over the years to migrate to the North. Thus the one hypothesis argues that superior ability is a result of migration to a more favored area, the other that the migrants were superior to begin with.

A series of studies of Negro school children who had moved to New York City from southern schools showed that these children had not initially excelled their southern classmates (Klineberg, 1935). Moreover, the longer these children had lived in the North, the higher their intelligence test scores tended to be. Although the latter results were obtained by testing different groups of children who had attended New York schools for varying periods of time, they were corroborated by a later longitudinal study conducted in Philadelphia (Lee, 1951). In the latter study, the same southern-born Negro children were retested periodically after one to nine years' attendance in Philadelphia public schools.

The few studies cited in this section illustrate the variety of approaches followed in the effort to isolate the operation of cultural and biological factors in racial comparisons, as well as the methodological difficulties encountered. In the light of available research, only the following conclusions appear to be justified: (1) to date, no biological or hereditary basis has been identified for any existing psychological difference among racial groups; (2) there is, on the other hand, considerable evidence, both from racial studies and from other research in differential psychology, indicating the role of cultural factors in producing the sort of behavioral differences found among racial groups; (3) because of the extensive overlapping between racial groups in all psychological traits, group averages provide a very poor guide for evaluating individuals of any race.

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CHAPTER 10

Social Psychology: The Individual

The principal goal of the field of social psychology is to describe and to understand the behavior of individuals within a social context. That is, the social psychologist strives to determine how past, present, and anticipated social experiences affect an individual's behavior relative to other persons. The importance of this field of inquiry to the development of psychology as a whole should be apparent to even the most casual observer. Man is basically a social animal. Not only is he dependent upon the actions of others for his very survival, but also much of his energy and time is expended in reminiscing over past social interactions, participating in ongoing activities with others, and planning for various future social experiences.

The pervasiveness of other human beings as a source of influence in the lives of children has been studied by Barker and Wright (1954). They undertook the ambitious task of surveying for one day the behavior of eight children. Classifying the events of the day for each child into an average of approximately one thousand behavioral episodes, they observed that the child spent 84 per cent of his time in *social episodes*, relating to other people; 15 per cent of his time in *potential social episodes*, in situations where others were present but to whom the child did not react; and 1 per cent of his time in *non-social episodes*, alone. The proportion of social episodes was undoubtedly elevated because of the almost continuous presence of an observer. Nevertheless, the researchers estimated that the percentage of time the children would have spent in social episodes in the observer's absence would have exceeded 50 per cent. Thus, for the child, it seems evident that the majority of his waking hours is spent in direct face-to-face relations with others.

The social environment affects the behavior of individuals even when they are not in immediate contact with others. Consider the act of writing the present chapter. The author is alone. However,

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much of his behavior is determined by the nature of his past and anticipated interactions with others. His choice of materials and of illustrative examples reflect in part previous interactions with persons in the field of social psychology, both through direct social contact and written documents. The speed at which the author is attempting to complete his assignment is in part due to his knowledge of the needs of an editor located some five thousand miles away. The acceptance of the task of writing the chapter undoubtedly derived in part from the author's anticipation of a variety of social rewards balanced against certain social costs.

The preceding observations are neither new nor startling. The importance of current and past interpersonal relations in the determination of behavior has been recognized for centuries. It is readily apparent in the works of the early Greek philosophers who sought to explain the relationship between certain human social traits and the political structure of society. It recurs repeatedly down through the centuries in the writings of moralists, of playwrights and novelists, and of historians. What is more recent is the attempt to obtain a systematic set of scientifically verifiable principles or laws concerning social behavior—an undertaking which demands the development and use of methods for the precise and controlled observation of behavior.

The recent development of the field of social psychology as an area of scientific inquiry is an interesting social phenomena in its own right. Although its slow emergence within the arena of science was undoubtedly due in part to the lack of appropriate instruments of measurement, the principal reasons can probably be found elsewhere. First, it was considered heretical to suggest that man's social behavior, including his religious and political beliefs, could be explained by scientific laws. Secondly, most individuals possessed their own idiosyncratic theories for explaining their behavior and that of their compatriots, and these common sense, often contradictory, systems were seen as sufficient to the task of understanding man's social behavior. Moreover, these "explanatory" systems often played a vital role in the psychological make-up of the individual. If one could maintain a belief that "primitive" peoples were biologically and socially inferior to "civilized" peoples, then one could rationalize a great variety of

discriminatory and exploitative forms of behavior. Finally, when serious thought was given to the problem of developing scientifically verifiable theories of social behavior, many persons believed that problems of description and explanation were too complex to be profitably pursued.

These three considerations still encumber the development of the field. But successes achieved by the application of scientific methods in other fields of inquiry, the discovery of regularities in human social behavior, and an increased concern with the inadequacy of our knowledge of such social problems as delinquency, crime, mental illness, war, and prejudice has led to the acceptance of the field of social psychology as a legitimate area for scientific inquiry. Simultaneously, more and more sophisticated measurement techniques—the questionnaire, various methods of describing interpersonal behavior, attitude scales, sociometric measures, and personality measures—have been developed, as well as more flexible and powerful mathematical and statistical techniques of analysis—factor analysis, scaling theory, variance analysis, and non-parametric statistics. Finally, there has been increasing pressure from other fields of basic and applied social science for the development of more adequate theories to account for the social behavior of individuals. Under the impetus of these combined forces, and aided by substantial financial support from private and governmental foundations, more research has been initiated in the field of social psychology during the past two decades than throughout its prior history.

BASIC VARIABLES

Two classes of variables are found in the development of scientific theories. One class, the actor variables, differentiates among acting units. The second, descriptor variables, differentiates the attributes, forces, relationships, and actions which characterize and affect the acting units. These descriptor variables play the role of independent and dependent variables in theory—independent variables defined as those which influence the actors, and dependent variables as characteristic responses of the actors.

The actor variables in an area of inquiry are therefore those objects, the functioning of which the theory attempts to describe—the "cast." The cast varies from one area of inquiry to another.

In physics, actors can be molecules, atoms or subatomic particles. The actors in chemistry can be basic elements or compounds. In biology, actor units range from molecules through cells, tissues, organs, individuals, and populations to societies. In social psychology the actor variables are generally human individuals or human groups.

The descriptor variables are those which impinge upon the actor or characterize its reactions. The descriptor variables in physics, for example, would include force, mass, time, and space. In social psychology there exist a large number of descriptor variables. In general, they can be described as belonging to one of three general classes: (a) *stimulus variables* which are external to the organism or group and can potentially affect its action, (b) *organismic variables* which represent attributes of the organism or group itself, and (c) *response variables* which characterize actions of the organism or the group.

In the present chapter we will focus upon the individual human organism as the actor unit, and upon those descriptor variables which have been theoretically and empirically employed to understand man's social behavior. In the following chapter, the group will be considered as the basic actor unit.

THE SOCIAL PSYCHOLOGY OF THE INDIVIDUAL

The simplest model of behavior is one that assumes that changes in immediate physical stimuli produce systematic changes in the responses of the organism. This model operates fairly well to describe the behavior of simple organisms. However, in the case of more complex ones, this simplistic, mechanistic model proves inadequate. For it can be observed that the same stimulus, say a gruesome Halloween mask, not only produces marked differences in response between children, but for the same child at different points in time. Obviously one needs to know more than what external stimuli the child is being exposed to in order to understand his behavior. Consequently, the social psychologist postulates the existence of various descriptor variables which specify certain characteristics or attributes of the organism at a given moment. These organismic variables are assumed to interact with immediate stimuli to determine behavior.

Much of the theory and research in social psychology has been directed toward defining and measuring how various organismic variables, for example, cognition, social learning, social motivation, and personality, interact with stimulus variables to affect behavior. In order to explain the differences in reaction to the Halloween mask, one might find it necessary to refer to the child's previous experiences with masks, his motivational state at the moment of its appearance, and his perceptions of the expectations of others as to what represents an appropriate response to such an object. It is the multiplicity of such organismic variables in addition to the complexity of the stimulus environment which makes the task of discovering rules of social behavior difficult.

OBSERVING RELATIONSHIPS

The social psychologist tends to select as stimulus variables those which refer directly or indirectly to other persons in the organism's environment, as organismic variables those which derive from man's social experiences, and as behavior variables those which refer to influencing or being influenced by other persons. He then attempts to discover relationships between these. Thus, he may investigate the relationship between several types of persuasive materials (stimuli) and the overt behavior of the organism toward some person or persons. He may be interested in how such stimuli affect the attitudes or motives (organismic variables) of the individual. Or he may attempt to describe the relationship between two attitudes, for example, attitudes toward religion and toward minority groups. Furthermore, he may ask how these attitudes affect behavior. Finally, he may consider the relationship between three classes of descriptor variables simultaneously—how various persuasive materials affect the behavior of individuals who vary in their attitudes toward a given minority group. Most social psychologists would agree that this latter, more complex type of analysis is necessary for the development of a comprehensive theory of social behavior. At the same time, it is possible, and perhaps necessary in the beginning, to consider only the relationships within or between a restricted set of descriptor variables. For instance, most research conducted in social psychology to date has examined the relationship between external stimuli and organismic variables, or as Lambert and Lambert (1964) note, "the

ways that social influences leave their traces on individuals."

HYPOTHETICAL CONSTRUCTS

It is important to recognize certain characteristics of the organismic variables which have been used in social psychology. Most often these variables refer to hypothetical entities, and thus are labelled hypothetical constructs. That is, they are variables which are inferred from the behavior of the organism, and are not in themselves directly observable. A surgeon performing an operation never runs across a bundle of social motives, or a collection of social attitudes. Rather these are constructs which the social psychologist invents in order to help him to explain why comparable stimulus situations produce different behaviors.

For example, if an apple is placed in front of a child at one time, and the child aggressively throws it at another child, and at another time he picks it up and generously proffers it to the other child, the social psychologist needs some way to account for these marked differences in behavior. To do so, he postulates that the child must differ in some respect from the first to the second instance. He may contend that the child was experiencing strong frustration at the moment of the first, but not of the second response. In this instance frustration becomes a variable characteristic of the organism, and since it can be assessed only indirectly, it is considered a hypothetical construct.

To be able to employ hypothetical constructs in a useful way, it is necessary not only to postulate their existence, but also to determine how they affect behavior. There are two major research strategies required to make such a determination. First, one can observe what environmental conditions produce a given effect upon a hypothesized organismic variable, measuring the effect by means of some set of overt behaviors which are assumed to correlate with the organismic variable. Second, one can manipulate the organismic variable either by modifying the environment or by selecting persons who are known to differ on the variable, and then observe the effects of this manipulation or selection upon social behavior in different situations. For example, one might determine how changes in the environment of the child influenced his level of frustration, and then given certain levels of frustration, determine their effect upon the child's behavior in various situations.

In the remainder of this chapter, we will consider the nature of social stimuli, review certain aspects of the aetiology and functioning of several organismic variables—cognition, motivation, and attitudes, and look briefly at the problem of defining social behavior. This method of ordering the field of the social psychology of the individual is obviously a fictitious one. Social psychologists do not theorize about stimuli independent of organismic variables, independent of behavior. Rather they search for relationships between them. The proposed division of topical areas should be viewed only as a convenient method for discussing theory and research as it pertains to the particular variables under consideration.

THE SOCIAL ENVIRONMENT AND PERSONS AS STIMULUS OBJECTS

Two categories of stimuli will be distinguished. The first, the social environment, is a global concept which refers to that part of the external world that affects the manner in which humans interact. The second, persons as stimulus objects, refers specifically to other individuals as stimuli. Obviously the latter, persons as stimuli, are part of the social environment, but the obverse does not necessarily hold. Variables such as climate, technology, and natural resources may affect the manner in which man relates to other men, and thus by definition be considered part of the social environment.

SOCIAL ENVIRONMENT

In considering the social environment, the social psychologist is concerned with three questions: What is the nature of the stimuli which make up man's social milieu? What factors account for a particular configuration of social stimuli? What effects does a given configuration have upon the way in which man interacts with his fellow men? The description of the social environment, plus a concern with what factors contribute to its emergence, form the predominant areas of interest for two major fields of inquiry—anthropology and sociology.

The anthropologist has been interested in determining the nature of the culture in which human beings are embedded. Culture has been defined by Margaret Mead (1955) as:

"... an abstraction from the body of learned behavior which a group of people who share the same traditions transmit entire to their children. . . . It covers not only the arts and sciences, religions and philosophies, to which the word 'culture' has historically applied, but also the system of technology, the political practices, and small intimate habits of daily life, such as the way of preparing and eating food, or of hushing a child to sleep, as well as the method of electing a prime minister or changing the constitution" (p. 12).

Through cross-cultural research, anthropologists have made detailed descriptive studies of the basic characteristics of a variety of cultures. These studies have revealed marked differences in the social environments of various societies. A number of anthropologists have also been interested in demonstrating how differences in the social environment of various cultures contribute to differences in personality. This relationship, as an area of anthropological study, has been emphasized by R. Linton (1945):

"Culture must be considered the dominant factor in establishing basic personality types for various societies . . . with respect to the formation of individual personalities, culture operates as one of a series of factors which also includes the physiologically determined potentialities of the individual and his relation with other individuals. There can be little doubt that in certain cases factors other than cultural ones are primarily responsible for producing a particular personality configuration. However, it seems that in a majority of cases the cultural factors are predominant" (p. 152).

The sociologist, in contrast to the anthropologist, has focused upon the description of various types of collectivities or groups which exist within a given society—the family, church, gang, labor union, social fraternity, and neighborhood community. They have been concerned not only with describing these collectivities, but also in examining the impact which they have upon the behavior of their members. Their descriptions of the structure and functioning of various collectivities have provided a wealth of information concerning the nature of the social environment to which members of various groups are exposed.

That the differences between social environments can be great even within a given culture is illustrated by comparing the environments of children who share membership in a middle-class suburban community with children who live in an

urban slum area. L. Murphy (1947) describes one suburban area of New York State in which 68 per cent of the adult population has had at least four years of high school education; in which 82 per cent of the working force is employed in professional, managerial and commercial jobs; and in which the children are taught by exceptionally well-trained teachers. In addition, the community supports a number of recreational activities for children ranging from various Scout programs to "open-house" parties for teenagers at the local high school.

In contrast, one can examine the social environment provided by the neighborhood area known as Harlem in New York City. Here, only a very small proportion of the adult population has completed four years of high school, the unemployed form a sizable proportion of the adult population, and two-thirds of the employed are engaged in manual and semi-skilled tasks. One observes inadequate and overcrowded school facilities, and these deficiencies, plus those in the home environment, markedly retard the rate of intellectual achievement of children in the area. Harlem school children are already one year behind their suburban counterparts by the third grade, and two and one-half years behind by the eighth grade. There is no doubt that children in these two communities live in markedly different social environments.

The sociologist is also concerned with the regularities in social behavior which occur among individuals who hold membership in certain groups, and who occupy particular positions within these groups. Most of the research in this area derives from role theory—a theory which attempts to discover the nature and effects of the behavioral expectations which attend an individual's occupancy of certain positions within collectivities. It seeks to describe and understand the behaviors which follow from holding such positions as father in a family group, minister in a religious group, and leader in a neighborhood gang. In these instances, the social environment, in the form of society, partly determines the appropriate behaviors of individuals who occupy particular positions within various collectivities.

The work of the anthropologist and the sociologist have provided the social psychologist with considerable information concerning the broad social context within which human behavior occurs. However, in dealing with the social environment

as a source of stimuli for behavior, the social psychologist takes a more detailed view than either the anthropologist or the sociologist of particular social stimuli impinging upon the organism at a given time.

PERSONS AS STIMULUS OBJECTS

Asch (1952) has observed that for humans to live in a social world requires that they have a knowledge of social facts—of persons and of groups. To recognize social facts implies that one can distinguish person objects from non-person objects. And to make this distinction it is necessary that person objects have identifiable stimulus attributes. Thus, one may reasonably ask, "What stimulus attributes distinguish persons from things?"

Obviously there are certain aspects of the physical dimensions of the object or person which the child uses from an early age to help differentiate persons from things—differences in shape, in the distribution of color, in the successions of movement, and in the nature of tactual and auditory stimuli presented. These necessarily become ordered and organized in such a manner that the child soon distinguishes human beings from trees, from tables, and from other animals. In addition, and of considerable more importance to the social psychologist, human beings learn to assign certain psychological properties to those stimuli which they encounter in their environment. Non-person stimuli are seen primarily as objects which exist and perhaps can be manipulated. There is a tree in the field, a bicycle to ride, a road to walk on. Person stimuli, in contrast, are not only viewed as objects which exist and perhaps which can be manipulated, but as centers of activity which have the capability of affecting one—of causing pain, frustration, happiness, or sadness. They are objects like oneself, and consequently one assigns to them those psychological characteristics perceived in oneself.

From a formal, physical standpoint, it is unlikely that the energy which impinges upon the organism's sensory apparatus to produce the percept of "person" differs in kind from that which results in the formation of a percept of any other object. Undoubtedly, as noted above, it is the way in which this physical energy is ordered and changes through time which enables one to distinguish a person from a thing. Furthermore, such changes in physical stimuli provide information to

the organism concerning the psychological properties of the perceived person object. The relationship between changing properties of physical stimuli and the perception of persons with psychological characteristics has been ingeniously investigated in a series of studies conducted by Heider and Simmel (1944) and Michotte (1954). These investigators have observed that variables such as change in direction and rate of movement of physical objects are often translated into human-type actions having particular psychological properties.

Heider and Simmel, for instance, presented a two and one-half minute movie to subjects in which a large triangle, a circle, and a small triangle moved in various directions at various speeds on the screen. In addition there was a rectangle which remained in a fixed position, but had one-half of one of its four sides open and close like a swinging door. One group of subjects were asked after viewing the film to describe merely what they had seen. In their descriptions the geometrical figures often became persons with definite psychological characteristics. A second group was asked what they had seen considering the figures to be human. A response of the following subject shows how changes in the ordering of geometrical forms can produce the perception of humans with distinctive psychological attributes:

"A man has planned to meet a girl and the girl comes along with another man. The first man tells the second to go; the second tells the first, and he shakes his head. Then the two men have a fight, and the girl starts to go into the room to get out of the way and hesitates and finally goes in. She apparently does not want to be with the first man. The first man follows her into the room after having left the second one in a rather weakened condition leaning on the wall outside the room. The girl gets worried and races from one corner to the other in the far part of the room. Man number one, after being rather silent for a while, makes several approaches at her; but she gets to the corner across from the door, just as man number two is trying to open it. He evidently got banged around and is weak from his efforts to open the door. The girl gets out of the room in a sudden dash just as man number two gets the door open. The two chase around outside the room together, followed by man number one. But finally they elude him and get away. The first man goes back and tries to open his door, but he is so blinded by rage and frustration that he cannot open it. So he butts it open and in

a really mad dash around the room he breaks in first one wall and then another" (pp. 246-247).

Heider and Simmel further observed that certain psychological attributes were assigned to particular patterns of physical stimuli. They note that instances in the film of successive movements resulting in repeated contacts between the geometric figures were reported as one person hitting the other, that occurrences of contact between one of the freely moving figures and the unmoving rectangle were seen as a person manipulating or being blocked by some aspect of his environment, and that when two geometric figures moved simultaneously in the same direction without contact, they were viewed as persons chasing or leading one another.

In summary, the perception of a person or a person-like object follows from characteristic distributions and patternings of physical stimuli. Once an object is identified as person or person-like, further changes in these physical stimuli result in the assignment of distinctly psychological characteristics to the object. And the nature of these assigned psychological characteristics undoubtedly plays an important part in determining the social behavior of the individual—particularly insofar as they affect the way in which the perceiver relates to the object perceived.

ORGANISMIC VARIABLES: COGNITION

Man continuously strives to order and to assign meaning to the events which occur in his physical and social world. This process commences with the formation of percepts of persons and objects in his environment. The assignment of meaning to these percepts and their integration with residuals of previous percepts can be defined as the process of cognition. The outcome of this process is the formation of a cognitive system—an interrelated complex of separate percepts of persons and objects. The importance of the process of cognition to social psychology is that the meaning an individual ascribes to persons and other social objects in his current environment is determined in large part by the content and organization of his previous percepts, of his existing cognitive systems. For unlike an electronic computer, man cannot be instructed to clear his "memory" and perform some new set of operations on incoming stimuli.

Rather man carries with him to each new social situation a history which plays an important role determining how he perceives the present. And the manner in which he forms such perceptions influences the way in which he behaves in the future.

Cognitive systems can obviously vary in content. If one is a member of the middle class, suburban New York community described earlier, he will have a different view of the world than a member of a Harlem slum area. For example, the significance and meaning of teachers is likely to vary markedly between members of the two communities. Cognitive systems can also vary in the ways in which they are structured. Krech, Crutchfield, and Ballachey (1962) distinguish three such structural differences: (a) *consonance*—the degree of congruity which exists among various percepts. If an individual classifies another individual as being friendly, kind, generous, and a wife-beater, one could assume that some incongruity may exist between the separate percepts; (b) *interconnectedness*—the degree to which one cognitive system is related to another. If in one cognitive system a high value is placed upon the democratic precepts of freedom and equality, and if in a second the belief is maintained that Negroes should be restricted to certain neighborhoods and social positions, then one can say that these two systems are not highly interconnected; and (c) *multiplexity*—the number and variety of percepts which form a particular cognitive system. For example, one individual may have a very simple view of modern painting, "it's not art." Another individual may have a much more differentiated view distinguishing a number of schools of modern art, a variety of media in which painters work, and subtle differences in the quality of paintings. The manner in which an individual assigns meaning to incoming social stimuli can be viewed as a function of both the content and the structure of existing cognitive systems.

CULTURAL BASIS OF COGNITION

The search for similarities and differences in the cognitive worlds of peoples of various primitive cultures represented one of the major activities of early social anthropologists. As a result of these studies marked differences were noted in the manner in which members of different cultures viewed their social and physical environments. The competitive, status-seeking Kwakiutl Indians

of the Pacific northwest were found to order their world—physical, social and metaphysical—in a markedly different manner than the cooperative, non-status-seeking Zuni Indians. In more recent studies an attempt has been made to go beyond the mere description of cognitive systems to the problem of discovering whether there are cultural differences in cognitive style.

For example, Gardner (1963) and Mercado *et al.* (1962) have conducted a series of cross-cultural studies to examine the way in which children conceptually differentiate and form abstractions of various objects and events. They have observed that Mexican children organize objects in their cognitive world in much more concrete terms than American children who are more likely to form abstractions. Thus, cultural variations exist not only in the content of cognitions, but also in the style in which information is ordered.

The effects of different social environments upon the cognitive orientations of individuals have not only been studied between cultures, but also between collectivities within a given culture. Allison Davis (1952), an American sociologist, in an extensive study of American class structure, found that cognitive orientations differed as a function of class membership. For example, in one community, members of the upper-upper class, those at the top of the social hierarchy by birth, differentiated the world of social class as follows: upper-upper ("old aristocracy"), lower-upper ("aristocracy but not old"), upper-middle ("nice, respectable people"), lower-middle ("good people, but nobody"), and lower class ("po whites"). Members of the lower-lower class had a less differentiated view of the class hierarchy combining the upper-upper, lower-upper, and upper-middle classes into one class ("society" or "folks with money"), and distinguishing the lower-middle ("way high ups but not society"), upper-lower ("snobs trying to push up"), and lower-lower ("people as good as anybody"). One observes that both upper-upper and lower-lower class members had a more cognitively differentiated view of social classes located closer to them on the social hierarchy, and that there existed marked differences in the types of characteristics assigned to persons at each class level.

The preceding studies comparing cultures and collectivities have been primarily of a descriptive nature. They have contributed to the development

of social psychology in two ways: (1) they have clearly demonstrated that the social environment can play a major role in determining how man views his social and physical world, and (2) they have yielded information concerning the variations in cognition which exist between particular cultures and groups. However, such studies do not explain how the social and physical world is translated into the particular cognitive orientation man carries with him from situation to situation. Nor do they indicate how cognitions interact with immediate stimuli from the environment and other organismic variables, such as motivation and attitudes, to determine man's interpersonal behavior. To examine more closely how cognitions are formed, and how they function to affect behavior, we turn next to the area of cognitive development.

COGNITIVE DEVELOPMENT

The basic task in the area of cognitive development is to determine how the child's comprehension of the world emerges and changes through time, and what variables account for these changes. Much of the work in this area of inquiry has been devoted to a description of various stages of cognitive development. Piaget (1929), on the basis of extensive observations of children in a variety of problem solving situations, has noted that the cognitive development of the child is characterized by an increasing degree of flexibility in viewing the world—the child moves from a fixed orientation toward physical and social objects to one in which he has ideas about them, to one in which he has ideas about ideas about these objects. This shift from concrete to abstract representations of the world undoubtedly has important implications for the manner in which the child interacts with other persons in his environment, although little empirical research has been undertaken in this area.

Social psychological theories, concerned with how the child develops his image of himself and others, have emphasized the critical role of the behavior of significant others toward the child during early stages of development. G. H. Mead (1934), an early pioneer in this area, has asserted that the manner in which persons respond to the child plays a central role in the development of the child's conception of himself and others. Those who have followed in the theoretical tradition of Mead have stressed three factors as major de-

terminants of the child's concept of himself and others: (1) maturational changes in the structure of the organism which are relatively constant from one culture to another; (2) the development of language which provides a method for the child to internalize the communications of significant others; and (3) a continuing series of experiences with significant others who provide information which the child uses to judge himself and the events in his environment. It is through the simultaneous operation of these three factors that the child's perception of the world, including himself and others, is shaped.

COGNITIVE ORGANIZATION

There are many stimulus parameters which, when varied, have been found to modify the way in which the individual organizes his cognitive world—the information available, the order of presentation of stimuli, the context in which stimuli appear and the distribution of stimuli through time. In a classic study by Asch (1946), subjects were requested to write their impressions of two individuals. One group of subjects was informed that the individual to be described was industrious, skillful, warm, determined, practical and cautious. A second group of subjects received the same list of descriptive adjectives except that the word "cold" was substituted for "warm." The impressions of the individual given by the two groups of subjects were markedly different, demonstrating that changing only one bit of information can markedly influence the cognitive organization achieved.

The manner in which new percepts are formed and ordered in cognitive systems is also strongly influenced by already existing systems. Starting from (his) theory of adaptation level, Harry Helson (1959) has conducted a number of studies to examine this phenomenon. The theory defines the level of adaptation as that point at which the organism is indifferent toward a stimulus object—is neither attracted nor repelled, neither positive nor negative, neither approaches nor avoids it. The level of adaptation is assumed to vary as a function of various conditions including the existing cognitive systems which are activated. Thus, the evaluation of incoming stimuli is influenced by those cognitive systems which are aroused. For example, physically aggressive behavior is generally viewed as a positive attribute in a game of ice

hockey, but considered highly inappropriate during a game of chess. In this instance, the evaluation of the perception of aggression is partly determined by the cognitive systems which are operating at a given point in time within a particular situation.

In one series of experiments, Rosenbaum (1956) varied two parameters, the intensity of an incoming social stimulus and the stimulus background conditions, and measured the effects of the interaction of these two variables on the subject's level of adaptation—his point of indifference. In one instance the intensity of the incoming social stimuli was varied by presenting subjects with a weak and a strong request to participate in a study; the background condition or cognitive set was varied by having a planted confederate of the experimenter either accept or reject future participation in the study within hearing of the subject. The experimenter observed that the subjects' points of indifference in terms of their willingness to participate in the experiment changed as a function of variations in these two conditions. The highest rate of willingness to participate was observed among those subjects who received a strong request to participate and who "overheard" others agree to participate.

Previously organized cognitive systems also play an important role in influencing how man samples and interprets stimuli in his environment. Underlying most social psychological research concerning the relationship between existing systems and the formation of new ones is the assumption that man seeks and interprets new information in such a way that it is congruent with existing expectations. Often in his search for cognitive consistency, man is forced into logically irrational forms of behavior. In the following example, Allport (1954) clearly demonstrates how an individual strives to maintain a consistent world in the face of contradictory information:

Mr. X: The trouble with Jews is that they only take care of their own groups.

Mr. Y: But the record of the Community Chest shows that they give more generously than non-Jews.

Mr. X: That shows that they are always trying to buy favor and intrude in Christian affairs. They think of nothing but money; that is why there are so many Jewish bankers.

Mr. Y: But a recent study shows that the per

cent of Jews in banking is proportionally much smaller than the per cent of non-Jews.

Mr. X: That's just it. They don't go in for respectable business. They would rather run night clubs.

The interpretation of incoming stimuli from one's environment in a manner congruent with existing expectations has been experimentally demonstrated in a study conducted by Thibaut and Riecken (1955). In this study subjects attempted to persuade two individuals to donate blood to a Red Cross drive. One of the individuals, a confederate of the experimenter, presented himself as a rather sloppily dressed freshman; the other, also a confederate, presented himself as a neatly dressed instructor. The experiment was designed so that each subject was successful in persuading both individuals to follow his recommendations. Subjects were then asked to indicate why they thought each of the two persons had complied. The responses they gave conformed to the differing expectations they held toward a freshman and an instructor. Subjects reported that the freshman accepted their arguments because the case they set forth was so persuasive, whereas the instructor accepted the same arguments because he was a nice person.

COGNITIVE DISSONANCE

In the preceding section we observed that a fundamental assumption underlying most dynamic theories of cognitive organization is that man strives to obtain consistency within his cognitive world. In recent years a number of social psychological theories have attempted to define those forces within the social environment, and the organism itself, which produce cognitive inconsistencies, and to examine the ways in which the organism operates to overcome these forces in order to maintain or reestablish consistency. Prominent among the theoretical and experimental work in this area are those efforts which have been stimulated by Heider's (1946) concept of "balance," Newcomb's (1956) theory of interpersonal relations based on the construct of "strain toward symmetry," Osgood and Tannenbaum's (1955) concept of "congruity," and Festinger's (1957) construct of "dissonance." As an example of the theoretical and experimental work

undertaken in this area, let us consider the concept of dissonance.

Cognitive dissonance, as defined by Festinger, is a state of psychological tension which has motivational properties, that is, which has the potential to cause the organism to act. The theory of dissonance is concerned with two major problems, (a) accounting for those factors which lead to the arousal of dissonance, and (b) describing ways in which dissonance, once aroused, can be resolved. The basic descriptor units of the theory are cognitive elements, i.e., bits or patterns of information and the relationship between them. Dissonance is assumed to occur when two or more bits of information are psychologically incompatible, "the obverse of one element would follow from the other" (Festinger, 1957, p. 13). Thus, in describing a person, the cognitive element "cheat" would in all likelihood be incompatible with the elements, friendly, kind, trustworthy, and religious.

The magnitude of the dissonance created by the incompatibility of cognitive elements is a function of several conditions including the relative importance of each bit of information and the ratio of consonant to dissonant elements. Reduction of dissonance is postulated to occur as a result of the organism's taking a variety of possible actions, for instance, changing one or more of the cognitive elements which are dissonant, adding new elements which are consonant with previous ones, or decreasing the importance or centrality of certain elements involved in the dissonant relationship.

A study by Festinger and Carlsmith (1959) provides an illustration of an experimental research following from dissonance theory. They investigated the effects of forcing an individual to behave overtly in a fashion inconsistent with his beliefs, and observed how subjects behaved as a result of the dissonance created. Subjects were first introduced to a series of tasks which were extremely tedious. Upon completion, each subject was informed that he had participated in a study on the effects of prior set upon task performance. He was told that in this experiment, a set was established by informing one group of participants that they were to take part in a highly enjoyable task, and the evaluations of the task by these individuals were to be compared with others who were given no prior information about the task. The subject

was then informed that he had been in the second group of individuals who received no prior information.

After this explanation of the study, the experimenter, appearing to be disturbed, observed that his confederate, responsible for informing the next subject that the task was highly enjoyable, had failed to appear. He asked the subject who had just completed the task to substitute in the role of confederate. To one group of subjects he offered \$1.00 in payment for being his confederate; to a second group he offered \$20.00 and, in addition, asked them to remain on a stand-by basis should the regular confederate again fail to appear. A third group of subjects were neither informed of the confederate's supposed absence, nor asked to play his role. After the subjects had played the role of confederate, all subjects were asked in another situation by another experimenter to rate the enjoyableness of the original "tedious" task.

The experimenters observe that dissonance is produced in the present experiment by the discrepancy between the true nature of the original "tedious" task, and the subjects' being paid to inform a naive, incoming participant that the task was highly enjoyable. The subject is assumed to be able to reduce this dissonance by changing his evaluation of the original task. Thus, the more the individual distorts the true nature of the original task, the greater the dissonance he must have experienced.

The ratings made by the subjects indicate that those who were not asked to participate as confederates, and those who received \$20.00, evaluated the "tedious" task as relatively unenjoyable, whereas those receiving \$1.00 rated it as rather enjoyable. The investigators interpret these differences in evaluation as consistent with dissonance theory. They note that subjects in the \$20.00 condition could more easily rationalize their inconsistent behavior, "I'm being well paid for telling a little lie." Subjects in the \$1.00 condition, however, could not so easily rationalize the inconsistencies in their behavior, and consequently were forced to change (distort) one of the cognitively dissonant elements—their evaluation of the enjoyableness of the original task.

MOTIVATION

The concept of motivation is employed by the social psychologist as a means of answering two

questions concerning social behavior: (1) why is man impelled to act, and (2) what determines the direction of his actions? Like cognition, motivation is a variable which is a characteristic of the organism, not directly observable, and therefore can only be inferred indirectly from the behavior of the organism. It intervenes between the stimulus world of the individual and his behavior, and interacts with incoming stimuli and other organismic characteristics to determine behavior.

There have been a variety of formulations concerning how motives develop and function. For purposes of discussing motivation in the context of the social behavior of individuals, we will define a motive as operating when some cue originating within the organism (a hunger pang, a feeling of boredom) or in the environment (a sunny day, a person smiling) arouses an expectation of a potential reward and/or discomfort which predisposes the organism toward some activity directed at obtaining the reward and/or avoiding the discomfort. For example, the perception of another person smiling may serve as a cue to arouse an expectation that an association with him might be rewarding, and thus result in communication.

CULTURAL BASIS OF MOTIVATION

The social environment of the organism plays an important part in determining the nature of his motives. In the development and arousal of motives, cultural factors enter the process at several points. They define for much of man's behavior what activities or objects in the environment are rewarding or punishing. For example, having more than one wife is socially rewarding in the Dahomey society in West Africa, whereas it is attended by social punishment in most Western societies. Cultural factors define what cues give rise to what expectations of reward and/or discomfort. Wayne Dennis (1940) has observed, "An infant who is hungry but who has never been fed from a bottle will not react to the sight of a bottle as one who gets his nourishment from this source. No Hopi or Navaho infant would react to the sight of a nursing bottle as many white infants do, because for the former it has never become a symbol for food."

Culture also plays an important role in specifying what activities on the part of the organism will result in the achievement of rewards or the avoid-

ance of punishment. Thus, if some cue in the environment arouses the expectation that one individual is about to strike another, the culture in part prescribes what actions may be taken to avoid this potentially painful state of affairs—whether to flee, to strike first, or to threaten retaliation. Finally, social factors help determine the strength of motives by helping to regulate the intensity of cues, the likelihood of obtaining a given reward or punishment, and the magnitude of rewards or punishments associated with various behaviors. In recent years many cross-cultural studies have been concerned with determining the ways in which different cultures and societies regulate the motives of their members, and hence exercise control over their behavior.

DEVELOPMENT OF MOTIVES

Motives develop through the interaction of the organism with its environment—particularly its social environment. In infants, hunger pangs produce crying, and the crying produces food mediated by the parents. In the beginning, of course, it is the parents who have the expectation that nourishment will be rewarding to the infant. With learning and maturation the child begins to internalize the expectations communicated to him by others—that if he behaves in a particular manner rewards or punishments will follow. “If you are a good boy when we go to the store, then mommy will give you some candy.” In this instance the external world, the mother, controls the cues, establishes the conditions under which rewards can be expected, and provides the rewards themselves. Later in the developmental process, the child can himself generate the cues and conditions for reward. “When I go to the store, if I give a dime to the clerk, he will give me an ice cream cone.” Finally, the child develops the capacity not only to recognize situations which may produce rewards and punishments, and behaviors appropriate to these situations, but also the capacity to administer rewards and punishments to himself. “If I finish my food, I will grow up to be a big boy.”

Thus, development of motives is characterized by a progressive internalization of the various conditions underlying motivated behavior. This process is strongly affected by the experiences which the child has with other persons in his immediate environment. It is from these individuals that he

learns many of the cues which are associated with potential rewards and punishments, what objects and relationships may be considered as rewarding or punishing, and what behaviors are appropriate under various conditions to achieve rewards or avoid punishments. By the time the child is in school, many motives are completely internalized. Consider the child facing a future examination (a cue). This future event gives rise to the expectations of doing well or failing, the first being rewarding, the second, punishing. The child has probably learned that one precondition for success is studying. The strength of the motive to study is influenced by several factors: (a) the likelihood that the exam will be given, (b) the child's estimate of the likelihood that success will be the reward for study, and (c) the relative importance of achieving success. Obviously social factors such as parental demands, teachers' expectations, and peer comparisons enter into this motivational equation at several points.

MOTIVATION AND FRUSTRATION

Motivated behavior is directed towards the achievement of rewards or the avoidance of discomfort. In certain instances the organism finds that its path toward reward or away from punishment is blocked, and frustration and conflict ensue. The blocking of motives can occur in a number of ways. First, a cue may give rise to the expectation of both reward and punishment whereby appropriate action for reward also brings discomfort. For instance, joining a fraternity may promise the social reward of acceptance, but the economic costs may also be great. Secondly, two motives may operate with the expectation of rewards for both, but taking appropriate action to achieve one blocks achievement of the other. For example, a businessman may be forced to decide whether to take a position which carries greater salary and prestige, or one which permits him to spend more time with his family.

Third, a conflict situation arises when two motives are associated with the expectation of discomfort, and taking the appropriate action for avoiding one ensures that the other will be experienced. A student, for instance, may have to decide to take an exam that he will likely fail, or feign illness. Finally, one or more motives may operate but the appropriate behaviors may be blocked by external physical or social constraints or by the

individual's own internalized norms of right and wrong behavior. Thus, an individual may want to join a group but the members refuse to invite him, or he may want to behave in an antisocial manner but is inhibited by his own sense of right and wrong.

The manner in which an individual responds to frustration is determined by the source and level of frustration, the behavioral alternatives provided by the social and physical environment, and the personality of the individual involved. Many of the characteristic ways of responding to frustration have implications for a person's interpersonal relations. In certain instances the organism responds to frustration by taking actions (either overtly or at a fantasy level) designed to harm other persons in its environment. Sometimes this aggressive behavior is directed toward those persons who are the source of frustration, and in other instances, it is directed toward persons who are not responsible, that is, the aggression is displaced. A classic example of the latter type of response is afforded by the employee who after being criticized by his boss, comes home and yells at his wife, who in turn scolds her son, who then kicks the family cat.

Another characteristic response to frustration is withdrawal. The person may leave, either physically or psychologically, those situations which give rise to conflict and anxiety. If another person is continuously a source of frustration, an individual is likely to refuse to meet him. If the individual is physically or socially constrained from leaving this other person, he may refuse to listen or communicate with him. The effects of such withdrawal upon future interpersonal relations have been observed by Newcomb (1947). He finds that feelings of hostility in an interpersonal relationship tend to protect themselves from change by reducing the communication of information which might produce change. Hostility thus becomes self-maintaining by the very fact that it leads to a reduction in communication.

Another characteristic reaction to frustration is projection, wherein the individual attributes to others feelings and characteristics which would cause anxiety should he recognize them as his own. This mechanism often has been described as playing a major role in majority-minority group relations. Minority groups are often viewed as acceptable targets by the majority for the projection of

their own undesirable self-attributes. Allport (1954) illustrates this mechanism by citing the history of the development of Hitler's attitudes toward the Jews:

His father, an illegitimate son of a woman named Schicklgruber, was an intemperate retired customs collector with whom Adolf had many fights. His mother, hard working, and dying of cancer when Adolf was adolescent, was dear to him. He was so attached to her that he may be said to have had a strong Oedipus complex. His father and mother were second cousins and required an episcopal dispensation for their marriage. Later in life Hitler was strongly attached to his half-sister, Angela. Still later he had his one great, passionate love affair with Angela's daughter, Geli—his niece. The nature of this relationship suggests incest. Geli was shot and killed (whether suicide or murder, no one knows) just as she was about to break off with Adolf. These facts are all of the unpleasant story that needs to be told, to show that there were reasons enough for Adolf to feel guilty (consciously or unconsciously) over the subject of incest.

Now, where does projection come in? By his own account, it was when he was 14 or 15, living alone and in great poverty and misery in Vienna, that his attention was called to the 'Jewish problem.' In his writings he blames the Jew in particular for sexual (including incestuous) misdeeds. In one passage in *Mein Kampf*, for example, he writes, 'For hours the black-haired Jew boy, diabolic joy in his face, waits in ambush for the unsuspecting girl whom he defiles with his blood.' Hitler was black-haired. His friends, in jest, called him Jewish. Writing of his leaving Vienna for Munich, he explained that he had grown to hate Vienna. 'I detest the conglomeration of races . . . Jews and more Jews. To me the big city appeared as the personification of incest.' Besides incest, all manner of other sexual misdeeds were attributed to Jews: prostitution and venereal disease (which was of special interest and repugnance to Adolf, judging from his writings.) Though we need not go into the matter here, there is strong evidence that Hitler suffered a severe sexual perversion which must have obsessed him and made him loathe himself at times—had he not been able to loathe others for the same propensities." (pp. 388-389)

It is apparent from this description that Hitler avoided the anxiety which attended guilt concerning his own sexual motives by projecting them onto members of a minority group.

A final example of a method for reducing conflict and frustration is rationalization. Rationaliza-

tion involves cognitively reconstructing the elements of a conflict situation in such a manner as to reduce the level of frustration. Berlyne (1957) and others have observed that the intensity of a conflict situation is a function of the number of competing responses, the degree of incompatibility between these responses, the absolute strength of the propensity to achieve reward or avoid punishment, and the degree to which the strength of the competing responses are equivalent. By changing any one of these elements, it is possible to reduce conflict and hence frustration. Rationalization involves construction of "plausible" reasons for changing elements. "I didn't want to be in that fraternity anyway. They're not democratic." "I was really ill at exam time." "Our team was the best. It was those biased referees which caused our defeat."

The preceding mechanisms are examples of characteristic ways in which the human organism responds to and attempts to reduce frustration aroused when motives are in conflict. As is readily apparent, most of these mechanisms operate to distort the perceptions of one's own and others' behavior. Much of man's interpersonal behavior which appears highly irrational to an external observer can be understood by examining the manner in which he attempts to reduce frustrations attending the blocking of his motives.

ATTITUDES

The concept of attitude has been at the cornerstone of most of social psychological theory and research. As observed by Katz and Stotland (1959), it was employed as an organismic variable by early behavioristic social psychologists to introduce flexibility into their mechanistic, stimulus-response formulations of human behavior—to account for those instances in which different stimuli produced the same responses, or in which the same stimulus produced a different response. On the other hand, early field theorists, who assumed that man's behavior could be explained in terms of the environmental and organismic factors operating at a given moment in time, employed the concept of attitude to account for the persistence of behavior through time. Thus, within one theoretical system, the concept was invoked in the name of flexibility, and in another, in the name of stability.

Although the concept has been theoretically

employed in several ways, its definition has remained fairly consistent. Generally, an attitude has been defined as a predisposition on the part of an individual to evaluate some concept, relationship or object in a positive or negative fashion. Attitudes thus have two primary components—a cognitive one which reflects the meaning attached to the concept or object, and an affective one which reflects the organism's positive or negative evaluation of the concept or object.

Two divergent attitudes toward the same object are found in two statements obtained by Deutsch and Collins (1958) during a survey of interracial housing. When an interviewer asked one woman living in an interracial project how she felt about living there, she responded:

I started to cry when my husband told me we were coming to live here. I cried for three weeks. . . . I didn't want to come and live here where there are so many colored people. I didn't want to bring my children up with colored children, but we had to come; there was no place else to go. . . . Well, all that changed. I've really come to like it. I see they're just as human as we are. They have nice apartments; they keep their children clean, and they're very friendly. I've come to like them a great deal. I'm no longer scared of them. . . . I'd just as soon live near a colored person as a white; it makes no difference to me.

In contrast compare the attitude of a woman in a segregated housing project who was asked how she felt about moving to an unsegregated project:

I don't want to have anything to do with colored people . . . they don't bother me . . . I don't mingle with them. I guess I don't like them because they're colored . . . the Bible says "God created them equal" so I guess they're equal, but I don't like them. I don't like living so close to them. I think they ought to be in separate projects. Let them live their lives and let us live ours. . . . My ideas haven't changed any since I've lived here. . . . They're colored and I'm white. They don't like us and we don't like them.

It is apparent that the cognitive and affective orientation of the first woman toward Negroes changed after she moved into an interracial housing project, and that there existed a sharp discrepancy between her new attitude toward Negroes and that of the woman who lived in the segregated project.

The content and the relationship between the

two major components of attitudes, cognition and affect, play an important part in determining whether or not some action will be taken toward the object of the attitude. Katz and Stotland (1959) provide the following example of the potential relationship between the cognitive and affective components of attitude and behavior. They note that if a person has a strong positive affective orientation toward a political party or candidate, if they are cognizant of where and when to vote, and if they believe that their vote can affect the outcome of the election, then they are likely to express their attitude behaviorally by voting. On the other hand, if a person has a weak preference, if he doesn't know where or when to vote, and if he believes that his vote is not important, then he is considerably less likely to translate his weak preference into voting behavior.

ATTITUDE FORMATION

As in the development of cognition and motivation, the culture and the groups to which an individual belongs play a major role in determining his attitudes. Whether an individual develops a favorable attitude toward eating snails, roasted grasshoppers, or honey ants is in large part determined by his cultural background. Similarly, his attitudes toward other persons and groups of persons within his own culture are strongly influenced by his own group membership.

Horowitz (1952) conducted a study in the late 1930's to determine the effects of cultural and group membership upon the development of attitudes toward Negroes. Selecting children from kindergarten to the eighth grade from various socioeconomic and geographical areas of the United States, he administered a series of questionnaires designed to measure attitudes toward Negroes. He found a steady, continuous development of less favorable attitudes toward Negroes beginning prior to the first year in school. He also observed that groups drawn from all-white and mixed New York schools, and from all-white Southern schools, displayed very similar patterns of responses. Finally, he noted that one small group of children, who came from families with communist parents, developed markedly less prejudiced views toward Negroes than the rest of the children in the study. Given these findings, he concluded:

... it has been found necessary to contradict many oft-repeated clichés. . . . Young children were found to be not devoid of prejudice; contact with a 'nice' Negro is not a universal panacea; living as neighbors, going to a common school were found to be insufficient; Northern children were found to differ very, very slightly from Southern children. It seems that attitudes toward Negroes are now chiefly determined not by contacts with Negroes, but by contact with the prevalent attitude toward Negroes" (p. 501).

In Horowitz's study, the children's attitudes corresponded to the norms of an entire culture, and followed the expectations of peers and elders rather than being based upon the child's own experiences with Negroes. Discrepancies from the general pattern were found within that group of children whose parents were communists, and who undoubtedly subscribed to norms of behavior which diverged from the general culture in a number of respects.

Although cultural and group factors undoubtedly play an important role in determining what attitudes a child will develop, there still exist a wide range of different attitudes between individuals who come from relatively homogeneous cultural and group backgrounds. In order to understand these differences, the social psychologist must examine the particular environment and learning experiences of an individual, his relationship with significant others, and other psychological characteristics such as motivation, cognition, and personality.

ATTITUDES AND PERSONALITY

Of particular theoretical and research interest to the social psychologist is the manner in which the development of attitudes is influenced by personality factors. One observes, for instance, that certain attitudes toward other persons are irrational in content insofar as they do not conform to the real world, and are highly resistant to change. It has been ascertained that such attitudes often develop because they provide the individual with a means of escaping anxieties and frustrations which attend motivational conflict. Such attitudes serve the individual by protecting his self-image. For example, as noted previously in the case of Hitler, holding negative attitudes toward minority group members may provide the individual a means to project his own feelings of hostility, sexuality, or

inferiority onto someone else, and thereby enables him to avoid conflict, anxiety, and guilt, and to bolster his own feelings of well-being and adequacy.

Other individuals seem to adopt particular attitudes because they need to conform to authority figures in their environment. Such individuals often behave as if they were incapable of forming independent opinions. They seem to feel secure only when they believe that their attitudes, regardless of their content, are consistent with those held by significant others. Riesman (1950) has described the psychological development of such conforming individuals as follows:

Approval itself, irrespective of content, becomes the only unequivocal good in the situation; one makes good when one is approved of. Thus all power, not merely some power, is in the hands of the actual or imaginary approving group, and the child learns from his parents that nothing in his character, no inheritance of name or talent, no work he has done is valued for itself but only for its effect on others. Making good almost becomes equivalent to making friends. "To him that hath approval shall be given more approval." The other-directed person must be able to receive signals from near and far; the sources are many, the changes rapid. What can be internalized, then, is not a code of behavior but the elaborate equipment needed to attend to such messages and occasionally to participate in their circulation. As against guilt-and-shame control, though of course these survive, one prime psychological level of the other-directed person is diffuse anxiety. The control equipment, instead of being a gyroscope, is like radar (p. 66).

The development and maintenance of attitudes therefore reflects not merely the organism's passive assimilation of existing cognitive and affective predispositions toward objects and persons, but also the active selection and maintenance of attitudes which serve the psychological needs of the individual—whether one likes a favorite uncle because he always brings a present, prefers a particular newspaper because its values are consistent with one's own, subscribes to a position because significant others do so, or dislikes a certain group of persons because it permits one to attribute to them one's own inadequacies.

ATTITUDE CHANGE

Initial research on attitudes was descriptive in nature. Population after population was sampled,

administered attitude scales, and described as holding certain attitudes toward a great variety of persons, groups, and objects in the environment. Gradually, the focus of research shifted from that of description to an active concern for measuring the development of attitudes, and the forces which could produce changes in attitudes. The interest in attitude change stemmed from two major considerations. First, from a theoretical standpoint, understanding how attitudes can be modified provides considerable information on how attitudes develop, on the role they play in the psychological makeup of the individual, and on the influence they have upon man's social behavior. Secondly, from a pragmatic standpoint, attitude change represents one of the major problem areas in the world today. The possibility of understanding and being able to modify attitudes has implications for such diverse areas as mental health, war and peace, human rights, and a myriad of other major social problems.

Early attempts to change attitudes were made by presenting an individual with new information concerning the object in question. However, it was soon recognized that this method seldom produced change. Individuals seemed prepared to reject, repress, distort, deny, or merely ignore new information which was inconsistent with their existing attitudes. As a result, social psychological theorists were forced to consider the role which attitudes played in the overall psychological structure of the organism, and to devise change procedures which would take into account the functional relationship between a given attitude and other psychological processes.

Katz (1960) has recently summarized four major psychological functions which attitudes have been found to serve: (a) *adjustment*—an attitude which is formed as a means of achieving a desired goal or avoiding an undesirable one. For example, an individual tends to like those objects or persons which provide rewards and to dislike those which are punishing; (b) *ego-defense*—an attitude which defends an individual's ego from conflict and anxiety. As noted previously, certain attitudes, such as hostility toward minority group members, often enables the individual to attribute characteristics to others that would cause considerable anxiety if he were forced to recognize them as a part of himself; (c) *value-expression*—an attitude which permits the individual to express

his own conception of himself, to assert who he is and what he values; and (d) *understanding* (knowledge)—an attitude which reflects an individual's attempt to assign meaning to the world about him.

Successful methods for changing attitudes depend upon the development of influence procedures which are appropriate to the psychological functions which a given attitude serves. A number of research studies have demonstrated the utility of various change techniques for attitudes serving one or more psychological functions. For instance, Carlson (1956) has observed that attitudes can be modified in some instances by demonstrating to the individual that his attitudes are inconsistent with his values and goals, and thus psychologically have a low utility. Katz, *et al.* (1956) have found that providing moderately ego-defensive subjects with insight into the defensive role which certain of their attitudes play in protecting their ego from anxiety is sufficient to produce change. Segal (1957) reports that the American prisoners of war in Chinese prison camps who were most likely to change their attitudes, to be "brainwashed," were those whose self-concept could most easily be undermined. Hyman and Sheatsley (1947) have noted that providing additional information or knowledge is effective in producing attitude change if this new information is consistent with existing attitudes. These four studies, as well as many others, point to the fact that attitude change can occur under a variety of influences, and that the success of a given procedure is determined in large part by whether it considers the psychological function that a given attitude serves.

SOCIAL BEHAVIOR

The goal of the field of social psychology, its *raison d'être*, is to understand man's social behavior. Social behavior can be given both a broad and a narrow definition. Broadly defined, it refers to any action taken by the individual which is the result of past, present, or anticipated social experience. For example, one would include within this definition of social behavior, the physiological reactions of the organism to social frustration, the actions which the individual takes to increase his social prestige, and those eating behaviors which result from cultural conditioning. More narrowly

defined, social behavior refers to those actions of an individual which are the result of other persons being in the immediate environment—behavioral conformity in the presence of others, verbal or physically aggressive responses directed toward another individual acting as a source of frustration, and imitative behavior. The decision as to which of these two classes of behavior to investigate, as well as what types of social behavior within a given class, is determined by a variety of considerations:

1. *The theoretical interests of the investigator, and the theories which are available to him.* The decision as to what social behaviors to study is markedly affected by the current state of knowledge in a given area, as well as types of relationships of theoretical interest to the researcher.

2. *The pragmatic interests of the investigator.* In the field of social psychology, many behaviors are studied not only for reasons of theoretical interest but also because understanding them may lead to certain social benefits. For instance, a great number of studies have been conducted which have more or less direct implications for understanding prejudice toward minority groups, criminal and delinquent behavior, social conformity, and other significant problems in the area of human relations.

3. *The empirical methods available.* Development in most areas of scientific inquiry are limited by the availability of suitable measurement techniques. In social psychology, the decision as to what social behaviors to observe is in part dependent on the availability of reliable and valid methods of measurement; and

4. *The social background of the experimenter.* Various social factors influence the theoretical and research strategy of the social psychologist as an individual. He may investigate certain types of social behavior because new discoveries would add to his own prestige, or because society provides strong financial incentives to work in the area. He may select certain types of subjects because of the facility with which he can obtain them. These and similar variables affect the decisions of the social psychologist, for his behavior is as socially determined as that of the subjects of his empirical investigations.

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CHAPTER 11

Social Psychology: Social Groups

In the preceding chapter we considered various factors which help determine the social characteristics and behaviors of individuals. In the present chapter, we will focus primarily upon the social psychology of groups, where a group is defined as possessing the following characteristics: (a) a collection of two or more individuals which can be objectively distinguished from other collections, a *collectivity*, e.g., all persons who hold membership in a family, all persons inhabiting a room at some point in time, all Republicans, or all high-school graduates; (b) in which the members interact with one another, an *interpersonal event*, e.g., a man negotiating a taxi fare with a cab driver, a boy purchasing a balloon from a vendor, or a son arguing with his father over the use of the family car; and (c) in which the participants pursue a more or less common goal, share a more or less common fate, and perceive themselves as distinct from other collectivities, a *group*, e.g., a family, a basketball team, or a campus fraternity.

Given the preceding definition, establishing a collectivity is a prerequisite to the occurrence of an interpersonal event, and forming a collectivity and engaging in interpersonal events precede the emergence of a group. It should be noted, however, that in the field of social psychology the question of what constitutes a "group" remains an issue which evokes considerable debate, and that each of the above conditions has, at one time or another, been taken singly as an adequate definition of "group."

In current theoretical and research efforts in social psychology, three major orientations are taken toward the investigation of social groups. The first considers the *individual* as the basic actor variable or unit, and examines the effects which membership in a collectivity, an interpersonal event, or a group have upon the behavior of the individual. The second is concerned with the *relationship* between two or more persons, and treats interpersonal events as basic actor units. It investigates conditions which influence patterns of interaction and interdependency which occur between individuals. The third orientation treats the *group* as the actor unit, and considers how variations in

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the environment and in the characteristics of the group interact to determine performance. In the present chapter we will review each of these approaches.

GROUP INFLUENCES UPON THE INDIVIDUAL

The problem of determining how the group affects the behavior of the individual represents an area which has been of historic concern to various fields of social science—political science, economics, anthropology, sociology, and social psychology. Its solution is a necessary prerequisite to understanding such diverse problems as political behavior, the transmission of culture, the socialization of the child, the aetiology of consumer demand, and the nature of social conformity.

It is a common observation that persons who share membership in a given group or collectivity display more similarities in behavior than members of other groups. Furthermore, it is frequently noted that when the attitudes or behaviors of a group change, those of the membership also change. In large part, the study of group influence is centered on discovering the forces which operate to produce these uniformities in behavior.

Cartwright and Zander (1960) have suggested three possible factors which may account for the commonality in attitudes and behavior observed among members of a given group or collectivity: (a) members share a more common stimulus environment than non-members; (b) members use the attitudes and behaviors of other persons in their collectivity or group as a standard against which to judge the accuracy and appropriateness of their own perceptions and actions; and (c) other group members, through the manipulation of rewards and punishments, press the member into forms of behavior which agree with their own.

COMMONALITY OF STIMULUS ENVIRONMENT

There can be little doubt that there is generally greater commonality in the stimulus environment of persons who share membership in a given collectivity than for non-members, and that such similarities produce uniformities in attitudes and behavior. Thus, we would expect greater stimulus similarity within than between the two communities described in the preceding chapter—a New

York suburb and a Harlem slum—and consequently more uniformity in attitudes and behavior among children within each collectivity than between them. Similarly, one would likely find marked differences in the stimuli available to the union members and the management of a given factory, and marked similarities in the stimulus world within each group. Consequently, it would not be surprising to observe greater uniformity in perception and behavior within the union or the management groups than between them.

The observation that members of collectivities or groups share a similar environment, and that this produces certain similarities in attitudes and behavior, is in part responsible for the development of the method of survey research. This method permits one to determine systematically and reliably the uniformities in attitudes and behavior which exist between various collectivities or groups. Its principal research tools are methods of sampling which permit one to obtain a valid estimate of the attitudes and behavior of a large population by collecting data on a relatively small sub-population, and questionnaires which enable one to collect a variety of information.

Campbell (1947), for example, conducted a survey using a sample of individuals drawn randomly from the white, non-Jewish adult population of the United States in order to determine factors associated with attitudes toward Jews. He found that in the total sample, 11 per cent of the respondents were pro-Jewish, 50 per cent showed no anti-Semitism, 21 per cent showed a mild dislike, 13 per cent a dislike, and 5 per cent were actively hostile toward Jews. He then examined the relationship between the attitudes held by the respondents and their various socioeconomic characteristics. He found that age, sex, and income were not related to anti-Semitism, that foreign-borns appeared to have slightly more favorable attitudes toward Jews than native Americans, and that prejudice was lower in more highly educated groups. Most striking differences were obtained between individuals who were economically and politically satisfied versus those who were not. Ten per cent of the economically satisfied persons expressed hostility, whereas 38 per cent of those dissatisfied expressed active hostility; 75 per cent of those economically satisfied showed no anti-Semitism, whereas only 39 per cent of those dissatisfied displayed no anti-Semitism. Similar findings

were obtained for measures of political satisfaction and dissatisfaction.

The preceding study, like most surveys, is correlational rather than causal. It seeks to identify whether particular attitudes or behaviors are associated with membership in certain collectivities or groups. Such studies are also employed for predictive purposes such as determining how a particular population intends to vote with respect to a political candidate or issue. The major utility of surveys is that they provide a means of obtaining reliable estimates of the opinions and behaviors of large collectivities or groups by sampling and interviewing a small proportion of their total membership.

OTHER ATTITUDES AND BEHAVIOR AS A CRITERIA FOR JUDGING OWN BEHAVIOR

One principal source of information for judging events in one's environment is the judgments of other persons. A propensity to check one's own attitudes and behaviors against those of others obviously begins in early childhood when the child in large part measures the legitimacy of his own actions and views against those of his parents and other authority figures. The propensity to use others as a criteria to evaluate one's environment, and to modify one's judgments to conform to those of others has been systematically investigated in a series of ingenious studies conducted by Asch (1952) and others. In Asch's original study seven to nine college students were seated around a table and given the following instructions:

This is a task which involves the discrimination of length of lines. You see the pair of white cards in front. On the left is a single line; on the right are three lines differing in length. They are numbered 1, 2, and 3 in order. One of the three lines at the right is equal to the standard at the left. You will state your judgment in terms of the corresponding number. There will be twelve such comparisons. As the number of lines is few and the group small, I shall call upon each of you in turn to announce your judgments, which I shall record here on a prepared form. Please be as accurate as possible. Suppose we start at the right and proceed to the left (p. 452).

In fact, all the subjects in the study, but one, were confederates of the experimenter. The confederates were given instructions to make incor-

rect estimates on particular trials. The one real subject was always seated near the end of the left side of the table so that he would make his judgment toward the end of a given sequence. Thus, he had an opportunity to check his estimate of reality against those of other members of the collectivity. The task of discriminating between lines was not difficult since subjects tested in an "alone" condition seldom made errors in judgment.

Asch observed that subjects modified their judgments 37 per cent of the time in the direction of the erroneous judgments of the confederates. That is, when faced with a group of individuals making responses which did not correspond to reality, they often abandoned their own evaluation and accepted that of the others. The feelings reported by the subjects provide insight into the processes operating: "To me it seems I'm right, but my reason tells me I'm wrong, because I doubt so many people could be wrong and I alone right"; "Probably I'm wrong . . . no, I don't mean that. If everyone saw it the other way, I guess I am wrong. But I still think I'm right"; "I feel disturbed, puzzled, separated, like an outcast from the rest. Everytime I disagreed I was beginning to wonder if I wasn't beginning to look funny."

In an earlier, now classic study by Sherif (1935), the effects of the judgments of others upon the subject's own judgment of a highly ambiguous stimulus were investigated. Using as his stimulus condition the autokinetic effect, i.e., the fact that when one fixates on a stationary point of light in a completely dark room it seems to move, he first determined each individual subject's judgment of the distance the light moved. Having these estimates, he placed two or three subjects together and again had each estimate the distance the light moved. He observed that the individuals' judgments in the two and three person condition changed from those made when they were alone. In the together condition, the judgments of the subjects tended to converge toward each other. This study and that of Asch clearly demonstrate that individuals often modify their judgments to correspond with those held by others.

GROUP PRESSURES

None of the preceding studies on the effects of social influence upon individual behavior deal

specifically with "groups" as defined at the beginning of this chapter. In most survey research studies one focuses upon membership in a given collectivity, and the occurrence of certain attitudes and behavior. In the Asch and Sherif studies, the subjects were involved in interpersonal events insofar as they interacted with others. However, there is no evidence to suggest that they participated in a group—that they shared with others a common goal, felt subject to a common fate, or had a sense of group identity.

Deutsch and Gerard (1955) investigated whether the strength of the pressures toward uniformity of judgment exerted by groups upon their members would be greater than those exerted upon individuals participating in an interpersonal event. In order to examine this question, they experimentally created various types of situations for the subjects, two of which are relevant here: (a) subjects were anonymous to each other, and were visually and auditorially isolated; and (b) subjects were in the same situation but received the following instructions:

This group is one of twenty similar groups who are participating in this experiment. We want to see how accurately you can make judgments. We are going to give a reward to the five best groups—the five groups that make the fewest errors on the series of judgments you are given. The reward will be a pair of tickets to a Broadway play of your own choosing for each member of the winning group. An error will be counted each time one of you makes an incorrect judgment. That is, on any given card, the group can make as many as four errors if you each judge incorrectly. The five groups that make the best scores will be rewarded.

Thus, the experimenters by means of instructions created a group—a collectivity composed of members who perceived themselves as distinct from nineteen other collectivities, who had a common goal, and who shared a common fate.

All subjects were then placed in a task situation similar to the one devised by Asch, and their responses were tabulated. The resulting data indicated that membership in groups produced considerably more conformity behavior, as measured by the agreement of the subjects with the false judgments of others, than membership in anonymous collectivities. The average group member

made more than twice as many errors in judgment as the comparable member of a collectivity. The researchers also reported that in a post-experimental questionnaire, seven of fifteen members in the group condition spontaneously mentioned a "felt" obligation to the other members of their group, whereas none of the individuals in the collectivities volunteered this comment. These post-experimental comments by group members were also quite different from those obtained in the original Asch study where subjects seemed primarily concerned with the reliability of their own judgments. In the present study, subjects in the group often emphasized their obligations to the other group members.

The preceding study and others have shown that there is greater uniformity among group members than among members of a collectivity. One may ask why this is. There are undoubtedly several reasons. First, individuals are more likely to join groups who already share their attitudes. Newcomb (1961), for instance, reports that in the development of groups within a student dormitory that perceived similarity in attitudes was an important criterion for the selection of fellow members. Second, membership in a group increases the amount and intensity of one's exposure to persons with certain attitudes and behavior. Third, an individual often joins a group because he finds the other members attractive, and he is more likely to emulate the attitudes and behavior of persons whom he admires.

Finally, the group itself exerts pressures toward uniformity in order to facilitate the achievement of group goals. It has been observed by Back (1951) and others that the more attractive the group is to its members, the more cohesive it is, and the greater influence it exerts to produce uniformity. Back experimentally created three types of more or less cohesive groups by manipulating three sources of attraction to the group: liking of other members, prestige afforded, and rewards achievable. He found that members of high cohesive groups were subjected to more influence attempts than members of low cohesive groups.

That the influence attempts of groups are directed at producing uniformity of opinion and behavior is demonstrated in a study by Schachter (1951). He experimentally created clubs of five to seven subjects plus three experimenter confed-

erates. Club members were given the task of reaching a decision on which of seven more or less punitive actions should be taken in regard to a juvenile delinquent. At the beginning of the discussion, two of the confederates took extremely discrepant positions from the mode position of the other group members, and the third confederate assumed the mode position. During the course of the discussion, one of the confederates maintained his extreme position, the second shifted from the extreme to the mode, and the third always maintained a position corresponding to the group mode. Schachter then compared the behavior of the group members toward the three confederates. He found that the persons who always occupied the deviant position received many more communications from other group members than the person who shifted from the deviant position to the group mode, or the confederate who remained at the mode throughout the discussion. In other words, groups expended considerably more energy on changing the opinion of the extreme deviant than upon those who conformed to their expectations. Festinger and Thibaut (1951) also have observed that when a discussion group was established in which opinions of the members on an issue varied over a considerable range, that 70 to 90 per cent of the communications were addressed to those who fell at the positions most discrepant from the mode of the group.

What if the influence attempts represented by this greater amount of communication to the deviant fails? What does the group do then? Evidence on this question was obtained by Festinger, Schachter, and Back (1963) who observed that members of social groups within a student housing project who did not conform to the standards or norms of the group were less likely to be chosen on sociometric tests measuring friendship patterns within the group. Schachter, in the study reported above, also observed that those confederates who were instructed to deviate strongly throughout the course of the discussion were rejected on a post-meeting questionnaire completed by the members. The latter systematically failed to include the deviant in a listing of persons whom they wanted to remain in the group. Obviously, if an individual is highly attracted to a group for reasons of friendships, status, or reward, and the price of nonconformity is rejection or expulsion, then there will exist strong pressures upon that individual to be-

have in a fashion consistent with the expectations of the group.

INTERPERSONAL EVENTS

An interpersonal event may be described as a series of interactions between two or more individuals. The social psychologist is concerned with describing and understanding: (a) the factors which determine whether an interpersonal event will occur; (b) the nature and determinants of the interaction process; (c) the outcome which the interaction affords the participants; and (d) their influence upon future behavior. For instance, consider two persons engaged in a tennis match. One can ask what are the factors that brought them to the game—what rewards did they anticipate. One can observe their interactions prior and during the course of the match in terms of the strategy which develops in the game itself, and the degree and kind of rewards they provide each other. Finally, one can assess the influence of these interactions upon each participant's outcomes, and examine how these outcomes influence future interactions.

In many contemporary formulations of the dynamics of interpersonal events (see particularly Thibaut and Kelley, 1959, and Homans, 1961), four fundamental assumptions are made. First, human beings are assumed to have the capability of rewarding one another. Second, it is assumed that an individual will enter and continue in an interpersonal event if the rewards in the relationship are greater than the costs—the latter being defined in part by alternative relations the individual must forego in order to participate in the present interaction. Homans uses the term "profit" to describe this interdependency between rewards and costs, "We will define psychic profit as reward less cost, and argue that no exchange [interpersonal event] continues unless both parties are making a profit." Third, it is postulated that the responses made by the participants during the course of an interpersonal event are directed at achieving high rewards at minimal costs. And finally, it is assumed that the outcomes of the relationship, and their effect upon the behavior of the participants is determined by the overall rewards and costs incurred during the interpersonal event.

THE OCCURRENCE OF INTERPERSONAL EVENTS

Man obviously does not enter into social relationships in a random fashion. Some individuals are more likely to interact with one another than others. Take the extreme example of an American tourist travelling in Germany who has a limited knowledge of the German language. This individual is likely to seek out persons who speak English. By so doing he raises the expectations that he will be able to satisfy his wants at a minimal cost. German merchants, recognizing this predilection on the part of American tourists, obligingly hang out signs noting that someone in the establishment speaks English. The resulting interactions are generally mutually rewarding. The American obtains the dinner which matches his food preferences with a minimum amount of effort and uncertainty, and the merchant is justly compensated.

One major factor which determines whether interaction will occur between two or more persons is that of ecology—namely, the physical time and distance which separates them. The importance of this variable in determining the occurrence of interpersonal events has been clearly demonstrated in the study of a student housing project conducted by Festinger, Schachter, and Back (1963). These investigators hypothesized, "other things being equal, the greater the physical proximity between two people, the greater probability that, within a given unit of time, a contact between them will occur." They tested this hypothesis by asking residents in the housing project to indicate the three people they saw most frequently socially, and discovered, as predicted, that individuals were more likely to cite others who lived close rather than far from them.

In Newcomb's study (1961) of the acquaintance process in a college living unit, similar results were obtained during the first part of the year. Students were more likely to select as friends persons living close to their own room. As students in the house got to know all the residents, however, similarity in attitudes became more important than ecological considerations in the choice of friends. That physical closeness is not always a sufficient condition to produce interpersonal events is demonstrated by the oft cited example of long term neighbors in an urban area who never interact with one another. However, physical closeness can lower the potential costs of an interpersonal event

and increase the availability of future rewards should certain needs arise. Forming an acquaintance with a neighbor increases the likelihood of rapidly and easily obtaining a cup of sugar, a particular tool, or a baby-sitter should the need arise unexpectedly.

A second major factor which influences the occurrence of interpersonal events is the psychological characteristics of the potential participants. Taking again an obvious example, one can cite the instance of a person who has a need to get across Paris rapidly, and who consequently seeks out someone able to satisfy this need, a taxi-cab driver. At the same time, numerous cab drivers seek passengers in order to satisfy the economic demands of their profession. The likelihood of the occurrence of an interpersonal event which will be mutually rewarding is relatively high. In this instance, the cab driver possesses certain relevant skills, knowledge, and physical resources; the passenger has the necessary information to indicate where he wants to go, and sufficient funds to compensate the driver for his efforts.

There have been several empirical studies reviewed by Thibaut and Kelley (1959) which illustrate the types of individual psychological attributes which others generally seek as potentially rewarding or lowering the costs of an interpersonal event. In reviewing a study by Bonney (1947), they note that certain of the traits associated with popularity imply having the capability of rewarding others; for instance, physical health, vigor, and being the source of new experiences. Other traits associated with popularity—emotional stability, tolerance, and good will—are ones that can lower the potential costs of entering a relationship. Gilchrist (1952) and Shaw and Gilchrist (1955) observe that persons prefer to interact with others who have the skills appropriate to completing a given task so long as the person choosing the skilled person does not anticipate that he will be rejected. In this instance, fear of rejection, and the potential loss of socio-emotional support may outweigh the potential rewards of associating with an individual whose skills could contribute to successful performance.

Jennings (1950), in a study of the interpersonal relations between girls at a state institution for juvenile offenders, also observed that the selection of other girls to interact with was made in terms of the potential rewards which the other could

provide. She found that girls who were most frequently chosen by others to "work with" and to "live with" displayed the following psychological attributes: faith in the ability of others, capability to establish rapport quickly, insistence on impersonal fairness, and the ability to make others feel that she would assist them in meeting their problems. It should be noted that when girls were asked to indicate persons with whom they liked to spend their leisure time, the psychological characteristics of those selected changed. In this instance, girls tended to select others who were more equivalent in social status. Jennings notes that such equal-status others were more likely to have similar leisure time interests, and were less likely to make the selector feel socially inferior. Thus, the perception of what psychological attributes would both reward and lower the costs of a relationship varied as a function of its goal.

Winch (1952) considered the role of psychological needs in forming relationships. He hypothesized that persons seek out others who are most capable of gratifying their needs, and that greatest need satisfaction comes from associating with other persons who have complementary rather than identical need patterns. Winch and his associates conducted several experiments (1954, 1955) to test this hypothesis. They found some evidence which confirmed their expectations, but discrepant findings in their own research and the results reported by other investigators suggest that both similarity and complementarity of needs can contribute to the potential rewards and costs which accrue from associating with others.

In summary, the factors which influence the occurrence or initiation of interpersonal events are numerous. Ecological variables undoubtedly play an important role. Furthermore, the psychological characteristics of the others, as they relate to the seekers' own needs, attitudes, and skills, play an important part. Finally, the likelihood of an interpersonal event is considerably augmented if two or more potential participants reciprocally perceive that the other(s) possess characteristics, both psychological and material, which will yield them high rewards at low cost.

THE SOCIAL INTERACTION PROCESS

The investigation of social interaction between two or more persons, and the factors affecting this process is an area of obvious importance to under-

standing social behavior. The area is a difficult one to conceptualize and for which to develop methods of measurement. The major obstacle is that the causal chain of events is extremely complex. Consider, for example, the simplest form of interaction where two persons are working together to complete a given task. Person A takes an action whose outcome affects Person B (and Person A as well); Person B responds to A's action, and the outcome of his response affects Person A (and Person B as well). If one reiterates this action-reaction sequence many times while simultaneously taking into consideration changes in the external world which may be occurring as the result of the actions of both participants, one begins to appreciate the complexity of the interaction process. Thibaut and Kelley (1959) observe, "Each subject's behavior is at the same time a response to a past behavior of the other and a stimulus to a future behavior of the other, each behavior is in part dependent variable and in part independent variable; in no clear sense is it properly either of them" (p. 2).

The most widely used technique for classifying behaviors which occur during an interpersonal event is Bales' (1950) Interaction Process Analysis. Bales has developed a system of categories for describing various verbal and gestural responses which individuals can make during an interpersonal event. These categories are not topical in nature, but are more a grammatical description of behaviors which can occur in discussion groups. Bales employs twelve such categories and assumes that any unit of verbal or nonverbal behavior can be assigned to one of them: shows solidarity, shows tension release, agrees, gives suggestions, gives opinion, gives orientation, asks for orientation, asks for opinion, asks for suggestions, disagrees, shows tension, and shows antagonism. The reader will note that the first three categories deal with the expression of positive affect, the middle six with task-oriented behavior, and the final three with the expression of negative affect.

This category system can be employed to describe social interaction or to determine the influence various factors have upon the interpersonal behavior of participants in small groups. For example, one can contrast the actions of individuals in a given group, manipulate various structural parameters such as group size, and determine the influence of these manipulations upon the

members' responses, trace who exhibits what types of behavior toward whom, or ascertain the influence of each member's behavior upon the responses of the other members.

McClintock (1963), for instance, placed subjects in a group situation with three confederates. During a first task the confederates strongly supported (rewarded) the subject for his contributions to the solution of a common problem. During a second task, the confederates withdrew their support of the subjects. Using Bales' category system, the behavior of the subjects was compared under support and non-support conditions. Marked changes in behavior were observed. First, the number of responses made by subjects decreased under non-support. Second, under non-support the proportion of the subjects' task-oriented responses decreased, and the proportion of socio-emotional responses increased. Finally, the increase in socio-emotional responses under non-support was observed to be due to the subjects making markedly more negative affective responses. Thus, changes in the social support afforded the subjects by others during the course of social interaction affected both the quantity and the content of the subjects' behavior toward the task and toward other group members.

THE OUTCOMES OF INTERPERSONAL EVENTS

Provided that a sequence of interactions has occurred, one may ask what effects the outcomes have upon the participant's future behavior. Let us return momentarily to our tennis match. If the outcome of the match is highly rewarding to both participants relative to the costs, or if, in Homans' terms, the profits are high, then both players are likely to modify their opinions of each other in a favorable direction. Furthermore, the likelihood that the participants will interact again in the future is enhanced. If, on the other hand, the sequence of interactions between the two participants has not been rewarding, or if the costs of the relationship were high, then the opinions held by the players of each other may change in a negative direction, and the likelihood of future interactions decrease.

The effect of the outcomes of previous interaction upon later behavior in interpersonal situations has been studied by Harrison and McClintock (1964). Subjects were assigned to dyads, and each dyad to one of three conditions: mutual suc-

cess, mutual failure, and control. Dyads in the mutual success and failure conditions first engaged in a reaction-time task and were informed that for group success both members had to respond to a stimulus within a fixed criterion time. The experimenters manipulated the situation so that both subjects in the mutual success condition met the criterion over a number of trials, and both thereby contributed to the success of the group. Similarly, the situation was arranged so that both subjects in the mutual failure condition failed to meet the criterion, and thereby both contributed to the group's failure. The control group did not participate in the reaction-time task. Half of the dyads in the mutual success and mutual failure conditions were immediately introduced into a game situation in which they could cooperate or compete. The other half of the subjects were introduced to the same game situation one week later.

The results of the investigation indicated that when dyads went directly from the reaction-time task to the game situation, members of the mutual success dyads cooperated with one another significantly more than members of the mutual failure or control dyads. With a one-week time interval between the reaction-time task and the game, mutual success dyads continued to cooperate significantly more than the control dyads. However, the mutual failure dyads now showed as much cooperation as the mutual success dyads, and significantly more than the control dyads. This increase in cooperative behavior on the part of the mutual failure dyads after a one-week time interval can perhaps be best accounted for by a forgetting or repression of their initial experiences. In any case, the nature of the outcomes experienced in prior interaction was found to have a significant affect upon later interactions. And among those dyads who went immediately from the reaction-time task to the game, those who experienced mutually favorable outcomes (high rewards) during an initial task were more likely to cooperate than those who had experienced mutual failure (low rewards) or those who had not previously interacted.

Schachter (1951), in a study discussed previously, investigated the types of behavior which members of a group displayed toward an individual who adversely affected the outcomes of their interactions. It will be recalled that in his

study, a confederate of the experimenter, playing the role of a constant deviant, received a disproportionately high amount of communication from other group members, but refused to modify his position. Such behavior undoubtedly lowered the outcomes experienced by the other group members in at least two ways: it raised the cost of the relationship because members were forced to use time and energy trying to modify the deviant's position which could have been used for more mutually rewarding activities, and it prevented the group from achieving its goal of unanimity in opinion. The fact that after the discussion the other members showed little liking for the deviant, and excluded him from plans for future activities, illustrates how persons are likely to act toward others who, by lowering the rewards and raising the cost of a relationship, affect their outcomes in an adverse manner.

THE STUDY OF GROUPS

The strong interest which contemporary social psychologists have in the scientific study of groups in large part derives from the pioneering theoretical and research efforts of Lewin (1947) and Moreno (1953) during the 1930's. Their investigations stressed not only the importance of the group as a stimulus condition for individual behavior, but also, the utility of treating the group as an entity in its own right, as a basic actor unit, and asking what variables could be employed to describe and understand the manner in which it functioned.

In the present section we will use an Environment-Group Characteristic-Performance paradigm in order to discuss some of the work in the area of the social psychology of groups. In essence, we will assume that the environment in interaction with various group attributes determines the group's performance. As in the social psychology of the individual, certain group attributes are hypothetical, that is, they represent convenient constructs which aid the social psychologist to describe and explain the performance of groups. For example, no one has actually observed the group characteristic of cohesiveness—members are not physically glued together. Nor can we point to a group norm or goal. Such constructs are postulated insofar as they enable one to account for variations or similarities in performance which

cannot be adequately explained in terms of changes in immediate stimuli. There are, however, some group attributes which can be directly observed, and consequently are not hypothetical. One can measure directly, for instance, the size of a group or the spatial arrangement of its members.

As in the area of individual social psychology, various research strategies are available to the investigator of groups. He can manipulate the environment and measure the effects of this manipulation upon group characteristics or overt performance. He can determine the relationship between two or more group characteristics, e.g., cohesiveness and group goals. He can manipulate the environment (create an external threat), select groups who vary on some attribute (high versus low cohesiveness), and measure the resulting performance (productivity). In the discussion which follows, we will divide the field into three areas: environmental factors, group characteristics, and performance, recognizing that social psychologists are ultimately interested in determining the relationships which exist between these descriptor variables.

ENVIRONMENTAL FACTORS

The nature and functioning of groups is markedly affected by the cultural and physical environment in which they are located. First, the number and types of groups in which an individual holds membership varies markedly from one culture to another. This observation has been explicitly made in a survey conducted by the World Federation for Mental Health (Mead, 1955):

Western social scientists find cooperating units in many parts of the world. But the concept of cooperation in most areas is different from that known to the West. Western cooperation refers usually to a group which has been created in terms of future ends for the benefit of the individual members; it is individual collective effort converging towards a unifying end. The cooperating units we find in Africa, Latin America, the Middle East, and China, however, are units with an organic basis deriving from the past and originating in birth, repeating past patterns, not reaching toward the future. Here an individual is born into a family, a village, a church group, and when he acts for the welfare of the unit, he is often merely fulfilling his prescribed role; the cooperation is incidental. To the outsider, they may appear to be cooperative, but within themselves they often

are not, since they are not collective. They are units, not groups; a Greek, for example, never applies the term "group" to a family or a village. Their ends are common, and not a collection of individual ends, and they are not in the future but part of the pattern of rooted activity (p. 182).

In such cultures, one is not likely to find children of four or five years of age forming clubs, electing or appointing officers, and then asking themselves, "Now we have a club, what shall we do?" Because of these intrinsic differences in culture, and because most group theory and research derive from studies within Western society, one must necessarily be extremely cautious in asserting that the observed relationships between group variables found in Western cultures necessarily generalize across all cultures.

Nevertheless, society influences the manner in which groups are formed and function. Let us examine a few examples of the group variables which it may affect:

1. *Size*—there often exist prescriptions within a society as to the appropriate sizes of groups. Thus, there exist expectations concerning the "right" size for a basketball team, a family, various clubs, efficient workgroups, etc.

2. *Membership*—various definitions can be found among societies as to the appropriate composition of groups. Some define the basic family as being composed of mother, father, children, and mother's relatives; others include the husband's older brother. Social norms limit the membership of other groups in terms of socioeconomic considerations, educational background, commonality of belief, skills, age-level, etc. In still other instances societies prescribe membership in terms of ecological considerations. For instance, Sprott (1958) reports:

In the People's Republic of China, cities are divided into Wards, like our own, but the Wards are divided into "neighbourhoods" made up of a group of "alleys." The families in the "neighbourhood," living as they do in courtyards, elect a chairman, and representatives of various Committees. The Committees are concerned with women's welfare, care of dependents of the armed forces, the tidiness of streets, literacy, and the general good behavior of the people living in the "neighbourhood" they represent. They vie with one another in local social activities, and one "Alley Leader" pointed with pride to the little litter baskets they had hung on the telephone posts, a convenience

which had been copied by other neighborhood units (p. 92).

3. *Rules of Behavior*—cultural norms often prescribe what role behaviors are appropriate to the members of various groups. Strodbeck (1951), for instance reports that the ways in which husbands and wives settle differences in opinion between themselves varies from culture to culture in the Southwest of the United States as a function of different norms. Among Mormons, the resolution tends almost always to be in the direction of the husband; among Navahos, in the direction of the wife; and among Texans, it tends to be a "fifty-fifty" proposition.

4. *Task*—the culture may also prescribe what tasks should be pursued by certain groups. In some societies, groups of women are responsible for all agricultural activities of the community; in other societies, groups of older children assume responsibility for the care of younger ones. Societies may specify whether groups can or cannot be formed to pursue particular religious or political activities. Within the military, various tasks may be assigned to particular subgroups, e.g., demolition teams, airplane crews, and tank crews. Finally, the tasks to be performed by the family in relation to the rearing of children are more or less strictly prescribed.

The nature of the physical, as well as the cultural environment, also plays a part in defining what groups will emerge and how they will function. For example, in societies which are primarily agrarian, in which the demands of economic and physical survival require long hours of tilling and harvesting the soil, the family is generally the dominant group. In such societies individuals participate in relatively few other groups, formal or informal. When the physical environment makes fewer demands upon the individual for sheer survival, as is the case in many Western societies, the family may lose its position of sole predominance, and numerous other groups develop in order to satisfy societal and individual needs.

There are additional ways in which the physical environment may directly or indirectly influence the formation and functioning of groups. We have already noted earlier the findings of Festinger, Schachter, and Back who observed the importance of the ecological variable of physical distance in the formation of friendship groups. Other important dimensions of the physical environment which

affect the functioning of groups include the availability of natural resources, climate, the presence of physical barriers, and the threat of natural disaster.

GROUP CHARACTERISTICS

In the course of studying groups, social psychologists have noted a number of group characteristics which will influence the group's performance. Although it is impossible to specify all of these here, we will consider briefly three which have received considerable attention: size, communication structure, and cohesiveness. In studying these attributes of a group, the social psychologist sometimes treats them as dependent variables, addressing himself to the question of how environmental or other group characteristics affect the attribute under consideration. At other times, he employs them as independent variables, asking how a given attribute interacts with environmental stimuli to determine group performance.

Size. Simmel (1955), a German sociologist writing at the beginning of this century, recognized the importance of the size of the group in determining the manner in which it functioned. He observed that as the size of the group changes, certain structures and relationships appear or disappear. In comparing a dyad with a triad, he noted that interpersonal relationships in a dyad are always direct, whereas in the triad there is, in addition to the direct relationship between any two participants, an indirect one with the third. In triads coalitions can be formed; in dyads they cannot. One fundamental difference between the dyad and the triad is reflected in the popular saying, "Two's company; three's a crowd."

A number of experimental studies have been made to determine the effects of size upon the functioning of groups. Hare (1952) reports that interaction patterns between members change as groups grow in size, that the formation of norms (rules of behavior) proceeds more rapidly in smaller than in larger groups, and that the satisfactions which attend membership decrease as the group's size increases. The latter finding, that satisfaction tends to be greater in smaller than in larger groups, has also been observed by Hewitt and Parfitt (1953). This reduction in satisfaction within larger groups can be attributed in part to changes in the distribution of interaction which occur as groups grow in size. Bales, *et al.* (1951)

found that the distribution of the quantity of interaction becomes increasingly unequal with increases in group size. In larger groups, certain members command a disproportionate amount of the communication process, whereas others interact little, if at all. Since the rewards of group membership derive in part from participation—both as the initiator and recipient of communications—the higher average satisfaction experienced in smaller groups, and the greater cohesiveness observed therein (Seashore, 1954) are easily understandable.

Communication Structure. The original theoretical impetus to recent investigations of the relationship between communication structure and group functioning came from a rigorously formulated model of group communication developed by Bavelas (1948). Research studies following this formulation have by and large examined the effects of variations in communication networks upon the performance of groups. Networks are constructed by specifying who within a group can communicate with whom. For instance, Leavitt (1951) compared the outcomes of two networks: a *circular* structure in which A and B, B and C, C and D, D and E, and E and A could communicate, and a *wheel* structure in which one man (located at the hub) could communicate with four others who in turn could communicate only to him. Leavitt observed that in solving a group task, the wheel structure produced answers more rapidly, required fewer messages or communications among group members, and resulted in fewer errors than the circle. However, he also observed that except for the individual at the hub of the wheel, members in the circular structure were generally more satisfied in performing the task than those in the wheel structure.

Shaw (1954) ran a similar experiment confirming Leavitt's findings for groups solving simple problems, but found additionally that the circle structure produced faster solutions to more complex problems. In a subsequent study, Shaw *et al.* (1957) found that free communication in which all group members were allowed to interact proved to be the most effective communication structure as measured by the time required to resolve a complex problem in human relations. Mulder (1960) has argued that a more important factor than the communication net in determining the effectiveness of groups is the degree of centraliza-

tion of the decision structure within a group, that is, the degree to which one individual makes the decisions. He observed that for both the wheel and circle networks decisions were reached more rapidly in those groups in which one individual assumed the primary decision-making role.

By manipulating the position of members in a given communication network, one is able to ascertain how the group behaves toward individuals who hold a more or less centralized position. For example, it has been observed that the likelihood of being nominated a leader is increased by holding a more central position in the communication network. Both Leavitt and Shaw, in the studies reported above, note that individuals occupying a more central position in a network showed greater satisfaction with the group task.

Cohesiveness. The construct of cohesiveness has historically been a central variable in most formulations describing the functioning of groups. Its importance derives from an underlying assumption that its presence or absence as a group attribute influences the general welfare and viability of the group—whether the group successfully engages its members in activities, achieves its goals, enforces its norms of behavior, attains and maintains a high level of morale amongst its members. Furthermore, understanding the role of cohesiveness in group functioning was viewed not only as important to the development of an adequate theory of groups, but also as a prerequisite for discovering applied techniques for creating stable and effective groups. The latter was and remains a major concern shared by the leadership of industrial, military, welfare, and other organizations.

Cohesiveness is most frequently defined in terms of Lewinian field theory as the total field of forces which act on the members to remain in a group. Back (1951), as noted previously, has specified three principal sources of forces toward cohesion: (a) the attraction of members to the group, (b) the possibility of the group's mediating rewards for the individual members, and (c) the status which can be achieved through membership. Moran (1964) has recently conducted a factor analytic study of the various attributes which have historically been employed to characterize cohesiveness. Using items which correlated highly with one another, he devised a scale which in turn successfully distinguished groups who behaviorally displayed characteristics associated with cohesiveness

and non-cohesiveness. From a qualitative analysis of the items employed in his scale, he defines the principal component of cohesiveness as an "identification with the group," or "a desire to retain membership in a group which is perceived as successful and striving toward a worthwhile and mutually agreed upon goal; a feeling of teamwork and willingness to accept work in the group's behalf as well as defending it from outsiders" (pp. 36-37).

As in the investigation of any group attribute, there are two fundamental questions which can be asked regarding cohesiveness. First, what variables influence or correlate with it; second, in what way does cohesiveness affect the functioning of groups? In regard to the first question, cohesiveness has been found to increase with the amount of mutual compatibility existing between members. Moreno (1953) observed, for instance, that if persons are allowed to choose their associates, the resulting collectivity is more cohesive than when individuals are randomly assigned to a collectivity.

Deutsch (1949), in studying the determinants of cohesiveness, compared groups whose members were rewarded for cooperating or competing, namely, the cooperative groups were rewarded for the joint achievements of their members whereas members in the competitive groups were rewarded individually. He observed that cooperative groups were more cohesive than competitive ones. Subsequently, Deutsch (1959) observed that groups, informed that they had a higher chance of succeeding at a task than other comparable groups, were more cohesive, as measured by the members' attraction to the group, than those who were told that their relative chance of success was low. Seashore (1954) found that groups whose performance was superior tended to be more cohesive. In the latter instance, it is not possible to ascertain whether better performance produced cohesiveness, cohesiveness resulted in better performance, or both.

It has also been observed that small groups tend to be more cohesive than larger ones. And finally, there has been some experimental evidence to support the widely held supposition that when threatened by an external danger, a group becomes more cohesive. Wright (1943), for example, investigated the effects of frustration upon the social relations of pairs of children of three to six years in age. He found that under frustration from an

external source, groups displayed an increase in cooperative acts, particularly groups composed of children who were already close friends.

The consideration of cohesiveness as an independent variable, that is, the determination of how differences in cohesiveness influences the functioning of groups, has resulted in numerous research studies. In general these investigations have found that highly cohesive groups exercise more influence upon their members' behavior than low cohesive ones. As reported earlier, Back (1951) found that more cohesive groups exerted more attempts to influence their members than less cohesive groups. Both Schachter (1951) and Festinger, Schachter, and Back (1963) report that there is less deviation from group norms in cohesive than in non-cohesive groups. Schachter *et al.* (1951) also found that cohesive groups are better able to control the level of group productivity than non-cohesive groups. They note that highly cohesive groups are not necessarily more or less productive than those low in cohesion, but that they are better able to enforce the norms of the group regarding the desired level of productivity.

In terms of individual outcomes, it has been found that in cohesive groups individuals feel freer to express their opinions (Moran, 1964), more satisfied with the activities of the group (Van Zelst, 1952), and less anxious and insecure (Seashore, 1954). Moran also observed that members of a cohesive group are able to evaluate with greater accuracy their own social position relative to other members than those in a non-cohesive group.

Thus, research to date has confirmed that groups differ in cohesiveness as a function of a variety of forces, and that cohesiveness in turn affects the performance of groups and the outcomes of individual members in numerous ways. In concluding this section, it should be mentioned that there remain a number of other group attributes which have been systematically studied, for example, group norms, group goals, and leadership. Unfortunately, it is not possible within the limits of a single chapter to review the research findings on each of these descriptor variables.

GROUP PERFORMANCE

In the present section we conclude our discussion of the social psychology of groups by briefly

summarizing some of the measures used to describe the performance of groups. Generally variations in these measures are considered as by-products or outcomes of the interaction of immediate stimuli and certain group characteristics. Thus, performance variables are generally treated as dependent variables except in those instances where an attempt is made to ascertain whether a correlation exists between them, for example, whether the quantity of group productivity correlates with its quality. In characterizing group performance, three categories of descriptor variables have been frequently employed: level of productivity, degree of satisfaction, and rate and quality of problem solving.

Productivity is generally defined as the number of units of work accomplished within a given time interval. Studies of productivity have indicated that the output of a group varies with the norms of production established by the group, and the degree of influence it exerts over its members. Coch and French (1948), in a well-designed and executed field study, investigated the factors underlying the resistance among groups of production workers to necessary changes in work procedures. They describe how one group of workers markedly reduced their level of productivity in response to changes in work procedure, although the new tasks were no more difficult than the old. In sharp contrast, they describe another group who increased both their standards and level of output in the new work situation. They observed that the factor which produced these marked differences in performance was the manner in which changes in work procedures were implemented. Those workers who participated in discussions of the need for change, and who made recommendations concerning how the change could be most effectively implemented, raised their rate of production following the change. Groups who were merely informed that the change was to be made, lowered their production rate after its implementation.

Group satisfaction or morale refers to the satisfaction of the members of a group with their activities and goals. Kahn and Katz (1960) have systematically reviewed a number of studies concerned with the influence of supervisor-subordinate relationships upon both group morale and productivity. They observe that both higher morale and higher productivity were found when (a) super-

visors fulfilled a leadership role by exercising their prerogative to make plans, and performed only those tasks requiring their special skills, (b) supervisors did not supervise too closely but gave their subordinates freedom to work independently, and (c) supervisors were employee rather than production or institution-oriented. Coch and French (1947) also report higher morale in those groups which participated in planning for changes in work procedures. In general, one would anticipate that group satisfaction or morale is highly correlated with the "psychic" profits (rewards minus costs) that members have received as a result of group participation.

Group problem solving or decision-making is generally assessed in terms of the speed and creativity of decisions reached. Numerous investigations have been carried out to determine the effects of environmental conditions and/or group attributes upon decision-making. For example, Carter *et al.* (1951) observed that larger groups tend to be less creative in decision-making situations than smaller groups. The researchers speculate that in large groups only the more aggressive members have an opportunity to express their ideas while the less forceful members are constrained from either contributing or criticizing. Slater (1958) found that in solving complex human relations problems, groups of five persons were the most creative. Members of smaller groups were observed to feel inhibited in expressing their ideas fully, whereas in groups larger than five persons, members reported a considerable amount of time was wasted in unnecessary activities, and a few persons tended to dominate the discussion. Gibb (1951) observed that the total absolute number of ideas generated by the group increased with absolute increments in group size, though the growth in ideas was not proportional to the increase in the number of participants.

A number of studies have compared the efficiency and creativity of group versus individual problem solving. From a survey of the literature, Bonner (1959) concludes that groups arrive at better and more rapid solutions to problems than individuals, if the groups carefully and critically assess the contributions of each member, successfully destroy those fixed sets toward problems which so often inhibit an individual from achieving a solution, and communicate openly.

SUMMARY

In the preceding chapter we reviewed efforts made by social psychologists to understand the social behavior of the individual. In so doing, we considered social factors which affect the development of human cognition, motivation, and attitudes, and the relationship between these attributes and behavior. In the present chapter we have examined the influence of groups in molding individual behavior, the nature of social interaction, social factors which determine certain group attributes, and the influence of these attributes—size, communication structure, and cohesiveness—upon group performance. In both chapters it has been impossible to review all the descriptor variables and relationships which social psychologists consider to be theoretically and empirically relevant to understanding an individual's social behavior or a group's performance. Consequently, the reader would be well advised to consider these two chapters as an introduction to the social psychology of individuals and groups rather than as definitive treatises on either subject area.

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CHAPTER 12

Abnormal Behavior: Its Nature and Causes

Unusual or abnormal human behavior invariably arouses popular interest. When a newcomer moves into a community he is soon evaluated by his neighbors. If he converses about the weather or about his garden he is a commonplace fellow and interest in him develops slowly. But suppose that the newcomer whispers "confidentially" to several people that he is the victim of a nationwide plot of persecution, that he is really hiding from a well-known organization all of whose members are seeking to injure him. Immediately gossip is rife and the man receives more than his share of attention. We are curious because we cannot account for the man's behavior in terms of common sense, and we are a little afraid of him because we tend to fear events that we cannot comprehend.

Can the science of psychology help us to understand the abnormalities of behavior as well as the more common kinds? It can. And furthermore, the understandings are based on general psychological principles which spring from the laboratory and apply also to normal persons. The study of behavior disorders is sometimes called "abnormal psychology," a term which may cause misunderstanding. The psychology is not "abnormal" even though the behavior may be.

WHAT IS ABNORMAL BEHAVIOR?

PICTURES OF BEHAVIOR DISORDERS

Persons whose behavior is disordered in various degrees are encountered in everyday life but often they are poorly observed and inadequately understood. Some thumbnail sketches of abnormal behaviors will help to define our subject matter. Each brief description gives only the present condition of the person; any attempt to trace his history or to find the causes of the behavior must be deferred.

The most common behavior disorders are the less severe ones conventionally called *psycho-neuroses* or *neuroses*, terms that are now used synonymously. Here are two examples.

BY LAURANCE F. SHAFFER

Fearful Behavior (Case 1). A college sophomore had persistently refused to speak aloud in class, even when called upon to do so. In a private interview with his department head he was able to talk, although hesitantly, and told of an uncontrollable fear that seizes him whenever he has to speak to a group. If he is pressed to speak he becomes red in the face, his heart pounds wildly, and at times his throat seems to become paralyzed. He is a capable student and has been able to pass his courses because he suffers no difficulty in expressing himself on written examinations. He attributes his condition to "heart trouble" but a careful medical examination reveals no organic heart disease. The heart symptoms probably arise only from the physiological effects of emotion. His condition may be described as a *phobia*, an unduly fearful response to a situation that most persons face without any such panic.

Inactivation Response (Case 2). In the North African campaign of World War II, a young artilleryman was exhausted after a long action and lay on the ground to rest. Three mortar shells burst near him, shaking him up somewhat but causing no real wound. About a half-hour later, he found that he could not take his right hand from his trouser pocket; in fact, he had an almost complete paralysis of his right arm. Even so, he did not report sick but was sent to a field hospital by an officer who discovered his condition. Here he appeared calm, cooperative, and free from anxiety, with no symptom but his paralysis. Brief treatment with drugs and psychotherapy relieved the paralysis and, incidentally, demonstrated that it was not due to an organic nerve injury. But when he recovered the use of his arm he showed anxiety and tremor, which had to be treated as new psychological problems (Grinker & Spiegel, 1943, pp. 57-58).

The more serious behavior disorders usually fall into a class called *psychoses*. A person with psychosis is ordinarily unable to care for himself or live independently in society. The next four cases are patients in psychiatric hospitals.

Withdrawing (Case 3). The patient is a young woman in her early twenties who walks stiffly across the room when propelled by a nurse. She does not sit down when offered a chair but, when forced, sits in an apparently uncomfortable position and remains motionless for five minutes. She

does not speak, even when questioned. When her arm is lifted to an awkward horizontal position she lets it remain there, holding the arm rigid for a long period of time. She has not talked since her admission five months ago and ignores relatives who visit her. She will not feed herself but swallows food that is put in her mouth. This patient shows a very complete *withdrawing* from the usual activities of living.

Intellectual Deficit (Case 4). A mature man walks with a dragging, slovenly gait and has severe tremors, especially of his hands. His most striking symptoms are revealed by his answers to questions about common information. Asked his age, he first says that he doesn't know; he would have to look at a calendar. Later he says that he is twenty-nine. (His real age is thirty-six.) He knows the name of the present President of the United States but not that of the preceding president. He can give his name but looks puzzled when asked where he is. Simple arithmetic problems are answered incorrectly: four times two is forty; five plus ten is one hundred. He does not know the date. This man shows a marked *intellectual deficit*, an incompetence in functions that he could once perform. He is also *disoriented* as to time and place.

Distorted Thinking (Case 5). A young man in the hospital says that he hears voices that speak to him almost constantly, sometimes scolding him and sometimes giving him instructions (*hallucinations*). He tells an interviewer that he received a course in X-ray work by radio. As a result of this instruction he can throw X-rays from his eyes and look through substances. He can see into the ground and has discovered treasures of gold, silver, and jewelry. People are jealous of this great power, he says, and his wife tried to poison him. He recovered some treasures from the ground but three prominent men stole his power and put him in "this prison" (the hospital). He holds to these *delusions* or distorted beliefs tenaciously, and has no sense of their unreality.

Excessive Variations in Activity (Case 6). A woman about fifty years old talks in a low and moaning voice. She answers questions very slowly but her replies are relevant and correct. She knows her name, her age, the date, and where she is. She says that she does not feel well, that "her head isn't right." She is constantly worried. When asked what she worries about she replies "Everything." This woman weeps frequently and seems over-

whelmed by disaster when, in fact, she has suffered no real catastrophe. She is *depressed*, and also shows retardation in her speech and movements.

A year later, the same woman shows a striking contrast. Still in the hospital, she is now laughing and talkative. Sleeping little, she is constantly in motion and keeps up a prattle of talk and song all day and much of the night. She is still capable intellectually and answers questions correctly when her attention can be secured. She often gives quick, joking replies; once when asked how she felt, she answered "I feel with my fingers!" She is *agitated*, and is said to show *manic* symptoms.

DEFINITIONS OF ABNORMAL BEHAVIOR

By derivation, the word *abnormal* means *ab*, "away from," a *norm* or standard. Abnormal behavior is, first of all, different behavior, a conception that has an important implication. As is true of other differences among persons, abnormal behavior exists in various *degrees*. Everyone knows that all people cannot be classed as short or tall. Instead, there are all quantities of stature between the extremes. Similarly, all forms of behavior cannot be classed as either normal or abnormal. A person who is extremely elated, constantly shouting, laughing, and singing, is clearly abnormal in this respect. So is an individual who is very depressed and who moans continually about his misery. But there are also persons who are a little overactive, or quite neutral, or a little depressed. A trait such as elation-depression is not divisible into two classes, or into three, but occurs in many small steps which differ in degree or quantity. The same generalization applies to other attributes of behavior and to the total condition of psychological distress or well-being. Therefore, all persons cannot be classified as being either "sane" or "insane," but only as possessing a greater or less degree of a relevant characteristic.

Defining abnormal behavior as different behavior is only part of the story; the questions remain of the *direction* of the deviation and of the *degree* of difference that must exist in order for behavior to be called abnormal.

If only the fact of being different were considered, any great deviation from the average would be labelled abnormal. In practice, however, good deviations are not too hard to differentiate from unfortunate ones. Persons who have high intelligence, who are realistic and rational, and

who participate effectively in social enterprises are not considered abnormal, while those who show the opposite extremes of intellectual deficit, delusion, and withdrawing are so regarded. In some traits such as elation-depression both extremes are abnormal because both excessive activity and excessive grief hinder the accomplishment of life purposes. In general, the good extremes facilitate further satisfactions and achievements and thereby make for a well-rounded life.

What constitutes normal behavior always depends in some degree on the beliefs of the culture in which a person lives. To cite extreme instances, a deluded person might become the medicine man of a primitive tribe or even the leader of a religious or political sect in a more civilized group. The definition of how much an individual must vary to be considered abnormal may also be influenced by the nature of his society. A man who constantly mutters to himself might be judged abnormal in an industrial and urban environment whereas he might get along well enough on a lonely farm or as a solitary trapper. Both the direction and the degree of deviation that are considered abnormal depend on the effects of his behavior on his total life experience.

THE EXTENT OF BEHAVIOR DISORDERS

THE MAJOR DISORDERS

The extent and significance of behavior disorders are often underestimated by persons who do not have professional contact with them. One useful indication is the number of persons treated in public neuropsychiatric hospitals, which provide care for about 85 per cent of the hospitalized patients. Most of the persons in such hospitals suffer from psychoses. A few have severe psychoneuroses and some are being treated for other conditions, as drug addictions, and are classed as neither psychotic or neurotic.

In the mid-1960's there were, in round numbers, about 500,000 patients in public psychiatric hospitals in the United States. In the course of a year about 140,000 new patients were admitted and 160,000 former patients readmitted for further care. In a typical year about 270,000 were discharged as cured, improved, or able to live with their families. About 45,000 patients per year died in psychiatric hospitals, a figure that is not large

in view of the considerable percentage of patients who are elderly people suffering from disorders of senility. The large turnover in hospital populations means that far more people are psychotic at some time in their lives than are affected at any one time. It has been estimated that of each thousand persons born, about fifty will be hospitalized for a behavior disorder at some time in their lives (Landis & Page, 1938).

From the earliest time in which statistics were kept until quite recent years, the number of patients in psychiatric hospitals increased annually. This fact did not, however, indicate that behavior disorders were multiplying alarmingly. Much of the increase was due to the growth of the entire population, and a not inconsiderable part to the greater longevity brought about by the control of infectious diseases so that more persons stay alive long enough to become senile. The remaining increase was attributed to a more adequate provision of hospitals for patients needing care and the improved acceptance by the public of psychiatric hospital facilities.

The peak in resident patients in psychiatric hospitals was reached in 1955 and there has been a slow decline since that year, in spite of a marked gain in the country's population. The decrease is due almost entirely to new methods of treatment, described in Chapter 14, which facilitate early discharge and permit some patients who formerly would have been hospitalized to be treated while they remain at home and often while they continue in their occupations.

THE MINOR BEHAVIOR DISORDERS

The less severe behavior disorders are mainly psychoneurotic reactions, such as those illustrated by Cases 1 and 2 near the beginning of this chapter. Psychoneuroses are very prevalent but no precise estimates of their incidence can be made. Census data give little help, as only the most severely psychoneurotic persons are hospitalized or apply for compensation for disability. In the absence of more exact information one has to rely on opinions based on experience. It has been estimated that from one-third to one-half of the patients who consult physicians regularly suffer from psychological disorders rather than solely from physical disease. These include the large numbers of anxious persons who describe themselves as

"nervous," and persons who interpret the circulatory or digestive manifestations of emotion as evidence of organic disease (Case 1). Conservative guesses are that about 10 per cent of the population suffers from an appreciable degree of psychoneurosis at any one time, and that almost everyone is at least a little psychoneurotic at some time in his life.

TWO INTERPRETATIONS OF BEHAVIOR DISORDERS

Two quite different interpretations of behavior disorders must be taken into account in order to achieve a full understanding. The two points of view may be illustrated by a simple example. Suppose we say to each of two persons, "Lift up your hand!" Neither complies. The causes of these failures to follow our directions may now be investigated. One person, we will discover, is totally deaf. Perhaps he is congenitally deaf because the structures of his inner ear never developed normally during the fetal period. Some congenital deafnesses are hereditary. Or, alternatively, the deaf person may have suffered from an infectious disease that permanently damaged his auditory mechanisms. The other person is not deaf, however, nor does he show any other organic disability. But he is a native Frenchman, has never learned English, and therefore cannot understand what we say to him. Thus behavior may be affected by a deficiency of *structure*, or by a deficient *functioning* of a normal structure. Broadly speaking, the functional variations are caused by what a person has *not learned* or, more often, by the unfortunate things he *has learned*.

THE NEUROPHYSIOLOGICAL INTERPRETATION

Neurology and physiology view a human being as a complex machine. Any failure of this machine to operate satisfactorily, then, must be explained as a defect in the mechanism, some part being out of order. The fault may be due to the failure of a part to develop normally or to its destruction by injury or disease. Such disorders fall within the province of the *neurologist*, a medical specialist who deals with the structure and operation of the neural pathways. Or, the structures of the nervous system may be prevented from operating normally by the ingestion of poisons such as alcohol, by

the malfunctioning of certain glands, or by some nutritional deficiencies. A part of the field of physiology is concerned with these conditions.

Psychology cannot ignore the neurophysiological interpretation if it is to present a comprehensive account of behavior disorders. The causes implied by these interpretations are not within the field of psychology but their results are unmistakably psychological. If a person cannot learn, remember, judge, or reason normally, psychology must be interested even when the causes are anatomical or physiological.

THE PSYCHOLOGICAL INTERPRETATION

Psychology sees a person as a striving organism, constantly trying to fulfill his needs under the conditions of his environment. Its chief concepts are therefore a person's motives, conflicts, and learned responses rather than his neurones or his chemical composition. The fundamental principles of behavior come from normal experimental psychology. The ways in which persons learn to act and think are basically the same whether the end result is normal behavior or abnormal behavior. Wrong answers or right answers, whether to school questions or life problems, are learned by essentially the same processes.

Suppose, for example, that a five-year-old child in a kindergarten never talks, does not join in the activities of the other children, and only draws away when the teacher approaches him. His behavior might be determined in large part by deafness or by mental deficiency, in which case the neurophysiological hypothesis would be fruitful. Examination reveals, however, that he is neither deaf nor mentally retarded. Further study of his home life shows that his parents quarrel frequently and bitterly, that his father pays little attention to him except to punish his misdeeds, and that his mother concentrates her affection on his younger sister, regarding the boy as "bad" like his father. In response to this situation, the boy has *learned* to withdraw fearfully from contacts with adults and to be silent. The main concepts of a psychological approach can be drawn from this example. The child, very normally, has certain needs for activity and expression and also has strong motives to be secure and to receive affection. His environment evokes a conflict between these needs, for whenever he does something he is scolded and

punished. He resolves his conflict by withdrawal, a response that is *reinforced* by his escape from punishment and from the threat of the loss of love.

The psychological interpretation is not antagonistic to the neurophysiological one. Physiological events occur in the nervous system whenever a person acts or learns or thinks. The psychological hypothesis explains behavior disorders as consequences of unfortunate learnings which occur in persons with *intact* nervous systems rather than in terms of diseases and injuries of the nervous system.

You must not conclude that some behavior disorders are entirely physiological while some others have only a psychological basis. Instead, many abnormalities of behavior are due to some combination of both kinds of causes. There are differences among behavior disorders, however, in the degree to which the physiological and psychological approaches are applicable, but both factors enter many cases in some measure.

STRUCTURAL DEFECTS AND ABNORMAL BEHAVIOR

The neurophysiological point of view has been strikingly successful in explaining some forms of behavior disorder. The approach is not a simple one because the structure of the nervous system is very intricate and the injuries and diseases that can affect it are even more so. It is impossible to describe many details of neuropathology in a book of this scope, but a few samples may be cited with some simplification to show how the neurologist goes about his work. A spinal disorder, one that involves a limited part of the brain, and one that affects the brain generally, will be used as examples.

An Ataxia (Case 7). An occasional sight on the street, formerly more common than it is now, is of a man who walks with a peculiar gait usually with the assistance of a cane. His legs are held far apart and are thrown forward with an exaggerated motion so that his feet are brought down with a sharp stamp. Both legs are affected. Such a symptom picture is called an *ataxia*, which means a motor incoordination.

Further clinical examination may reveal the particular kind of ataxia and the location of the

nervous system damage that causes it. Let us suppose that this man can stand erect with his eyes open so that he can watch his surroundings, but sways or even falls if he tries to stand with his eyes closed. His knee-jerk reflex is diminished or absent. He is likely to show a peculiar abnormality of the pupillary reflex of the eye—the pupil contracts normally when accommodating to distant vision but does not contract when a bright light is made to shine in his eye. If he is asked to put his finger to his nose with his eyes closed, his aim is found to be very poor. Other tests may show that he has lost the kinesthetic or muscle sense of the movement and position of parts of the body. He walks so poorly because he does not “know where his feet are” unless he watches them. From all of this information, the neurologist is led to suspect that the man suffers from *tabes dorsalis*, also called “locomotor ataxia,” a disease which also has other symptoms, including severe pains in the legs, crises of extreme internal pain usually in the stomach, and irregular impairment of skin senses.

If the diagnosis of *tabes dorsalis* is confirmed, the neurologist can identify exactly the location of the neural defect. It is due to a degeneration of the posterior columns of the spinal cord (see Fig. 12-1). Through these columns pass the kinesthetic

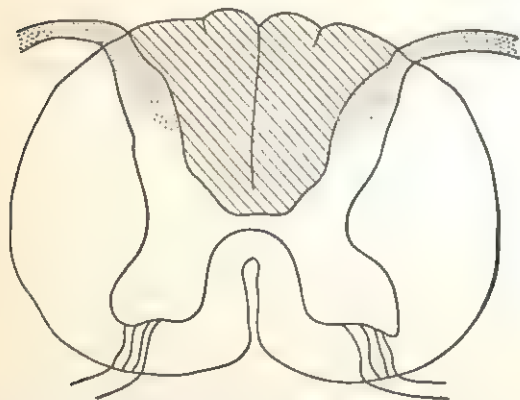


Fig. 12-1 Typical spinal cord degeneration in *Tabes dorsalis*. The shaded area represents the posterior columns which carry impulses for the sensations of tactile location and muscle movement to higher centers. The sensory nerve roots, shown by the dotted areas, are also affected.

impulses from the peripheral nerves to the brain. Furthermore, *tabes dorsalis* is always caused by a

syphilitic infection that particularly affects these posterior columns. With the more effective treatment of primary syphilis in recent years, the disorder has become much less common. It should be noted that there are other ataxias caused by different defects, as of the cerebellum, but neurological examination can distinguish these from *tabes dorsalis*. In each instance, the neurologist can describe the behavior disorder satisfactorily in terms of neural structures.

An Aphasia (Case 8). An accumulation of gas in a building exploded with great violence and several persons were injured, including one young man who suffered a severe skull fracture when a piece of steel penetrated his brain from the left side just above the ear. He survived this injury rather remarkably, but when the first shock was over it was discovered that he could not talk. He understood language fairly well and was able to communicate by means of signs and gestures, but when he tried to speak only a meaningless jargon of sounds passed his lips. This case belongs in the broad class of *aphasia*, a disorder involving the ability to communicate by means of words.

Aphasia is caused by injuries to the brain areas that control the language functions (Fig. 12-2).

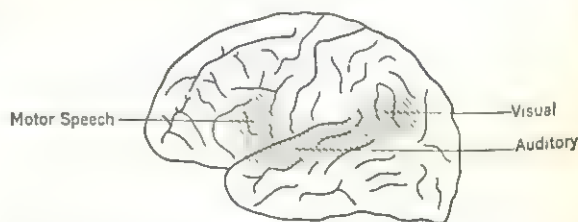


Fig. 12-2 Brain areas most often damaged in cases of aphasia. The shaded area in the frontal lobe is affected in *motor aphasia*, that in the temporal lobe in *auditory aphasia*, and that in the parieto-occipital region in *visual aphasia*.

These are located at the side of the dominant hemisphere of the cerebrum, which is the left hemisphere for most persons. Adjacent parts of each of the four lobes of the hemisphere are involved, each correlated to some extent with distinct functions. According to the classical view of aphasia, which is questioned by some authorities but still seems to have a degree of value, there are two main sorts of the disorder, *motor aphasia* and *sensory aphasia*. The case described here is principally of the motor variety. The young man's

ability to understand language is little affected but he^e cannot produce speech sounds successfully. Among the sensory aphasiae are distinguished *auditory aphasia*, the inability to understand spoken language, and *visual aphasia* or *alexia*, the loss of ability to read. Most cases of aphasia cannot be classified into these categories sharply, both because the brain functions are not so clearly differentiated as the classical theory implies and because injuries usually affect more than one limited area.

Many cases of aphasia recover gradually and are aided by special methods of re-education. The young man described was wordless for ten days; then nurses succeeded in teaching him to say a few simple words such as "drink," "orange," and "milk." After three months he had relearned his vocabulary fairly well and would pass for a normal person. Examination of the brains of aphasic persons, and analogous experiments with lower animals, show that the damaged brain area does not recover its former functions. Instead these processes are taken over by adjacent undamaged areas as re-education goes on. If the damage is too extensive the possibility of retraining may be very limited.

A General Cerebral Infection (Case 9). A man in a state psychiatric hospital shows a variety of symptoms, three of which will receive particular attention. First, he displays a marked *ataxia*, somewhat like Case 7. He has a shuffling gait, a general incoordination of movement, and shows some of the same reflex signs, as did the case of *tabes dorsalis*. Second, he has serious *intellectual deficit* like that of Case 4, described on page 208. He does not know the date, where he is, or who the people around him are. His information is scanty and he cannot perform the simplest arithmetical tasks. From these symptoms and others, and from the course of his disorder, the neurologist recognizes that the patient has *syphilitic meningo-encephalitis*, a disease also called *general paresis*, an older term still commonly used. If the neurologist is asked to explain the intellectual deficit, he may say that the whole brain is affected, which is well confirmed because the disease is indeed a widespread syphilitic infection of the brain tissues.

But the patient shows a third kind of symptom of even greater psychological interest. He has "expansive" *delusions* of power and wealth. He says that he has millions of dollars, hundreds of

wives, and thousands of children. He is (at various times) a president, a general, a king, or God. The hospital is his palace and all of the other patients are his servants. How are these delusions explained by the neurological approach? The neurologist says again that the whole brain is affected which is true enough but not sufficiently specific. It explains the poor judgment that permits a delusion to be harbored but does not explain the source of the delusion. There is something positive about a delusion that cannot be dismissed merely as a "weakness of judgment." Moreover, not all cases of syphilitic meningo-encephalitis show expansive delusions. Many simply deteriorate intellectually; some are depressed while others are agitated. One promising hypothesis points to the patient's past history—to the kinds of responses that he has learned to make in the face of his life problems—as a factor that may determine whether his behavior when psychotic will be apathetic or expansive or depressed. Thus the psychological theory is brought to bear where the neurological theory leaves off.

PSYCHOLOGICAL CONFLICTS AND BEHAVIOR DISORDERS

The psychological interpretation of behavior disorders uses concepts such as motivation, conflict, and adjustment which also apply to the everyday lives of normal persons.

THE PROCESS OF ADJUSTMENT

The course of life may be regarded as a series of adjustments, in which each person behaves so as to satisfy his needs under the conditions created by his circumstances. An act of adjustment begins when a need is aroused and ends when it is satisfied or at least reduced. For example, everyone gets hungry several times a day, seeks food, eats, and is satisfied—an adjustment that is both inevitable and beneficial. Similarly, a timid child approaches a group of youngsters playing a rough-and-tumble game, becomes afraid, and runs home to mother. The latter response is probably not good for the child's ultimate development, but it is an adjustment because it satisfies the motive that is dominant at the time; running to mother reduces his fear.

The process of adjustment has been investigated by animal and human experiments in the labora-

tory as well as by observations of everyday life. The familiar problem-box and maze experiments illustrate this process clearly. At the outset, the experimental animal is motivated by hunger. The reduction of his need is prevented by the conditions of the experiment, because it is in a small cage which provides no obvious or accustomed way to get food. Next, the animal makes varied, exploratory responses one of which will be, at first "by chance," the pressing of a small lever which protrudes into the box. Pressing the lever activates a device that releases a bit of food into a tray. The animal eats, thereby completing one unit of an adjustment process. From experimental and real-life examples, adjustment can be described in terms of four concepts: (1) *motive*, (2) *thwarting*, (3) *varied responses*, and (4) *solution*.

The same sequence may be observed in the complex social adjustments of human beings. If a man loses his job not only are his economic needs thwarted, but also strong socially learned motivations such as his need to maintain the esteem of his family and friends and his own self-regard. In response to these thwartings, the man ordinarily makes varied responses of inquiring and searching until, if he is fortunate, he achieves a solution by securing employment.

Not all adjustment processes end so constructively. If he is unable to find a job, the man may sit at home and blame others for his troubles, even to the extent of coming to believe that he is being persecuted. Or he may complain of being weak and ill and demand that other people support him. These unconstructive "solutions" do not end the problem of unemployment, but they are adjustments nonetheless because they tend to reduce the man's distress by making him feel that he is not to blame. Such inadequate substitute solutions are the key to the understanding of behavior disorders.

MOTIVES

The motives that evoke adjustive behavior are conveniently classed as *physiological needs* such as hunger, and *socially acquired motives* such as the desires for achievement and approval. When the physiological needs are mainly satisfied, as is typical in highly developed societies, the social motives are the most significant bases of human adjustments. These social motives are very com-

plex and cannot be reduced satisfactorily to a list of names.

The social motivations are acquired, mainly in infancy and childhood, by learning processes which occur in interpersonal relationships. For example, an infant or young child is given all of his most vital satisfactions of food and comfort in the presence of other persons, so that by the familiar process of reinforcement the very presence of others becomes gratifying for itself. As a result, most of us become "gregarious," and solitary confinement becomes one of the most unendurable of punishments. The negative instances also confirm the learned nature of social motivation. If a person is observed to shun the company of others, an examination of his life history will show that he was relatively isolated so that he did not learn to be gregarious, or else that his past experiences with significant people were more painful than gratifying. Parallel accounts could be given to show how most persons learn strong motivations to be secure, to gain recognition, to achieve, to excel rivals, to overcome obstructions, and the like. Such social motivations vary considerably from one culture to another because different circumstances offer different reinforcements for learning.

FRUSTRATION AND CONFLICT

A thwarting is any circumstance that prevents the satisfaction of a motive. It is convenient to distinguish two main classes of thwarting—frustration and conflict.

Frustration is a situational thwarting, in which motive fulfillment is blocked by external obstacles or by the activities of other persons. A child is frustrated when a desired object is out of reach or when a parent or teacher forbids him to take it. Both experimental evidence and clinical observations show that simple frustrations rarely lead to serious difficulties of adjustment. When frustrated, you usually try harder and persist until you find a solution, or else relinquish the goal if it is unattainable. In some instances, frustration may lead to aggression, an angry attack on the thing or person that stands in the way.

Conflict occurs when two or more incompatible motives are aroused in the same situation. A child may feel dependent on his mother and affectionate toward her but, on the other hand, aggressively

hostile toward her if she frustrates him unduly. In such a conflict, the child feels guilty and anxious about his own impulse of hostility. Conflicts vary in degree, of course, and not all of them are disastrous. Everyone has some conflicts, and resolves or compromises them with reasonable success. But severe and prolonged conflicts underlie many features of behavior disorders.

Experiments on Conflicts. The effects of conflicts are illustrated dramatically by some experiments with animals. Masserman (1943) trained cats to open a food box and eat when a light and buzzer signal were given. After this response had been well reinforced, conflict was induced by giving the cat an electric shock and a blast of compressed air just as it was responding to the food signal. The conflict was between the impulse to approach the signal that "meant" food and the impulse to flee fearfully from the same signal that "meant" painful punishment. The cats showed striking behavior disorders. They trembled, cried, and had disturbances of heart rate and respiration whenever the signal occurred. The generalization of the response was notable. They avoided the food box and some even refused to eat in their living cages. They showed "defensive" behavior of hyperactivity and aggressive acts against other animals, or else licked their own fur excessively as if this response comforted their fear. Moreover, the behavior disorders lasted for months even when there was no further stimulation in the apparatus. The marked effects of conflict were in contrast with those of mere frustration. When frustrated, as by blocking their way to the food box with a glass partition, the cats tried vigorously for a while and then extinguished their response to the food signal. None became "neurotic."

Sources of Human Conflicts. Many severe conflicts of childhood arise from the relations of a child to his parents. Children are always dependent on parents or parent-substitutes for support and also for affection and approval. When parents are cold and unresponsive, when they use punishment as their only technique for training, the child may also learn to fear them. He both loves his parents and fears the withdrawal of their love, leading to an attitude often called *basic insecurity*. Almost all people experience this conflict in a mild degree, but when it is severe the conflict may generalize to other persons and con-

tinue into the adult years. A child so reared may always show an excessive craving for affection and a fear that it will be withdrawn, a conflict which hampers his relationships with people.

Recent studies have given emphasis to the peer relationships of children and youth as sources of conflicts. A boy who has a strong fear of being hurt, or of failure in competitive sports, experiences conflict when he tries to play with other youngsters. He wants to play but he fears the result of his want, which is the essence of conflict. Other conflicts can arise at all stages of human development including adult life. Our culture causes almost everyone to acquire a strong drive to excel, succeed, and get ahead of others. But people also learn the opposite motives of being helpful and considerate, and of inducing people to like them. As a result many people who try to push ahead feel guilty about their own aggressiveness, giving rise to conflict.

INTEGRATIVE AND NONINTEGRATIVE ADJUSTMENTS

A person who is frustrated or in conflict is in a tense, stirred-up condition. Some of his excess drive comes from the fact that his thwarted motive is unfulfilled. More important in many instances is a particular emotional response resulting from conflict, which is usually termed *anxiety*. Anxiety is akin to fear, but a person usually recognizes an object that he fears and tends to avoid it. In contrast, anxiety is a response to anticipated catastrophe, to a highly motivated situation in which a person feels helpless and unable to achieve any constructive solution.

In his more fortunate adjustments, a person seeks the positive satisfaction of his motives. The results, of course, may vary in quality. If a man's motivation is for achievement, he may secure satisfaction by actual success in his work, by substitute accomplishments in hobbies or sports, or by joining some group or movement that makes him feel important. These are not all of equal value but they are relatively constructive solutions.

In less favorable situations, the individual is motivated less by drives which lead to positive satisfactions, and more by the need to reduce his anxiety. He may fear the steps required for real achievement, but *must* bring about some kind of a compromise adjustment in order to relieve his discomfort. If he is motivated to achieve but fears

competition he may resolve his conflict by finding excuses for his lack of accomplishment, by exaggerating his disabilities, by daydreaming of unrealistic successes, or by developing a belief that other people are maliciously preventing him from reaching his goals. Such behaviors do not lead to real achievement, but they are powerfully reinforced by the reduction of anxiety. These illustrations lead to the core of the psychological interpretation of behavior disorders. *The deviant behavior is performed and learned because it reduces the anxiety caused by conflicts.*

The quality of an act of adjustive behavior is best judged by the effect that it has on a person's other adjustments, in his present and in his future. A "good" adjustment may be described as *integrative*, or tending toward wholeness, because it helps a person accomplish his other life aims. Real achievement, for example, satisfies a person's present motivation and also facilitates other accomplishments in the future. In contrast, a "bad" adjustive act may be defined more precisely as *nonintegrative*, because it gets in the way of the satisfaction of other needs. A youngster may have a strong desire to impress other people favorably, but may also fear social contacts because he has often been ridiculed. In response to this conflict he may withdraw from contact with others, or else he may behave so aggressively that they avoid him. His nonintegrative adjustments keep his anxiety from getting out of hand, but they defeat his real purposes. The concepts "integrative" and "nonintegrative" are best applied to adjustive actions, not to persons. Even the best of us have some anxieties to which we respond with nonintegrative actions, and severely maladjusted persons are not entirely ineffective. The psychology of behavior disorders is the psychology of nonintegrative adjustments, great or small.

Consciousness in Adjustments. It must not be supposed that anyone deliberately chooses to become nonintegrative in his adjustments. Quite normal persons are not very clearly aware of all of their motivations or of how they are satisfied. The concept that many motivations and adjustments are largely unconscious is an important principle in psychology, but it is often misunderstood. There is no part of "the mind" called "the unconscious" to which rejected impulses and painful conflicts are banished. Instead, "unconscious" should be

understood as a functional concept, as a way of acting, not as a thing or place. Many motives and conflicts are not conscious because they were acquired very early in life before they could be stated logically or in words. Other conflicts become unconscious as a means of adjustment. To "not think about" a painful topic is one way to control anxiety, and therefore is a very common form of acquired adjustive behavior.

Maladjusted and neurotic persons "stumble upon" nonintegrative adjustive solutions because they reduce anxiety. On doing some act or thinking of some idea, the person vaguely "feels better," but he is quite unable to tell why. Thus, adjustive responses are reinforced because they satisfy motives or relieve anxieties, not because they are selected rationally or consciously. No person would choose to become deluded, but an individual with delusions gradually acquires his distorted ways of thinking because they help him to compromise or relieve some of his personal needs.

PERSONALITY

Behavior disorders, except for some arising from specific organic causes, rarely make a sudden appearance; instead, they develop gradually over periods of time. A study of the life history of a nonintegratively adjusted person usually shows the development of traits that forecast his later condition. A deluded person is likely to be described as "always suspicious of others and conceited about his own abilities." From such observations, the theory has evolved that the *personality* of an individual is a basic or predisposing cause of behavior disorder. This concept has much value, but is susceptible to a serious misinterpretation.

An individual does not act as he does "because" he belongs to a certain personality type. Instead, what is called his personality is evidence of the kinds of adjustive responses that he has acquired by reinforcement. A theory of inherent personality types therefore puts the cart before the horse. It is incorrect to say that a man withdraws because he has a withdrawing or "introverted" personality. His present behavior shows that responses of withdrawing have been reinforced, strongly and frequently, in his past life, mainly by the reduction of his anxiety. Another person, because different

circumstances have affected his learning, may use other kinds of responses instead. Fearful, self-centered, excuse-making, overaggressive, or complaining personalities are the *end results* of processes of adjustive learning rather than the sources of these adjustments. A highly reinforced type of response tends to be made again when the situation recurs, and tends to generalize to other situations. Personality, therefore, may be defined as an individual's *persistent acquired tendencies to make certain kinds of adjustments*.

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- See Ch. 14, p. 241, for suggested readings on behavior disorders.

CHAPTER 13

Abnormal Behavior: The Minor Behavior Disorders

MECHANISMS FOR ADJUSTMENT

Frustration or conflict leaves motives unsatisfied and is likely also to arouse the added drive of anxiety. A person so stirred up is stimulated to engage in varied behaviors until he hits upon a response that fulfills his need or reduces his anxiety. The "successful" response is thereby reinforced, and the probability is increased that the person will make this response again when he encounters a similar situation. A useful term, which has developed in psychology over a period of many years, designates such well-reinforced tension-reducing responses as *mechanisms*. A mechanism for adjustment is a learned response or a pattern of responses which reduces a drive.

The number of mechanisms used for personal adjustment is not indefinitely large, so that the common mechanisms can be designated by names and described in terms of their adjustive functions. If, for example, a person reacts to a frustrated need for recognition by showing off, being unnecessarily loud, and interrupting others, these responses define one type of mechanism for adjustment. They are called "attention-getting mechanisms," a term which describes their nature and utility. The exact responses that comprise attention-getting mechanisms vary from person to person, and from one time to another in a given person's life. A named mechanism, therefore, does not designate a limited, specific reaction, but a broad pattern of responses which have some essential similarity.

Because everyone has to adjust, and no one's behavior is perfectly integrated in all respects, adjustment mechanisms are shown by all persons from the most normal to the most severely disturbed. Furthermore, an important psychological discovery is that the same mechanisms are used by ordinary people in everyday life and by psychotic persons in hospitals. Almost everyone is likely to relieve the anxiety caused by a sense of failure by making excuses or blaming other people. These are forms of "rationalization," a very common mechanism. A deluded patient may believe that he is a victim of a conspiracy that keeps his greatness from being recognized, which is also

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a form of rationalization because it helps him to explain away his sense of failure. The study of mechanisms in one's own behavior is of value in itself, and also shows the continuity of behavior from the normal to the abnormal. No one can understand the nature of delusions unless such mechanisms as compensation, rationalization, and projection are understood first.

"DEFENSE" AND "ESCAPE" MECHANISMS

Some common patterns of adjustive behavior have often been categorized as mechanisms of defense or of escape. These concepts have value as an aid to thinking about behavior disorders, but they are not mutually exclusive. Mechanisms cannot be classified sharply as either of "defense" or of "escape."

Defense mechanisms have been so designated because they seem to defend a person against his own self-accusations of being guilty, shameful, or inadequate. Many children experience painful failure, are scolded by their parents or teachers, or are hooted by their peers when they try to achieve or excel. As a result, a learned connection is formed between situations that call for evaluation or competition and the painfully anxious response of fearing failure. One way to resolve such a conflict is to try harder, to assert one's adequacy all too insistently as a way of overcoming one's fear. Defensive mechanisms are relatively aggressive in nature and usually involve interactions with other persons.

Another way by which a person may cope with a fear of failure is by getting away from the stimuli which evoke it. Escape mechanisms, by definition, are less active and more solitary than the defensive ones. But it must again be emphasized that the concepts of defense and escape are not always antithetical; some behaviors may contain elements of both. A youngster who excels in a solitary hobby may be escaping from evaluations by others and at the same time defending his own self-esteem.

COMPENSATION

A compensation is a substitute achievement, developed as a defense against the anxiety evoked by a sensed failure in some other achievement. Compensations have two adjustive roles. First, they are replacements for the frustrated achievement and therefore indirectly satisfy the original

motives that were thwarted. Second, they distract a person from thinking about his failures or shortcomings and center his attention on a more gratifying accomplishment. A compensation mainly serves as a self-deception: It does not fool other people very successfully, for ordinarily they see through the person's overmotivated attempts to assert his superiority.

Compensations are often found in the aggressive behavior of children. One boy was referred to a clinic because of persistent troublemaking in school and bullying on the playgrounds. He also stole small articles from stores in the neighborhood. Psychological study showed, beneath this aggressive exterior, a boy who was extremely anxious about his physical capabilities. He had suffered an unusual number of injuries during the few years preceding, including three fractures. Perhaps more importantly, his father was absent from home most of the time and his mother added to his timidity by overcautioning him against getting hurt. His motives for physical mastery and for recognition—normal ones with high value in the culture of boyhood—found compensatory outlets in safely attacking smaller children and in fomenting classroom disorder. He stole to appear a "tough guy" before his companions. Thus he calmed his anxiety about his fragile physique by compensatory aggressiveness.

Compensation appears in many other forms. Lack of social recognition may give rise to attention-getting mechanisms. Threats to one's intellectual self-esteem have their typical compensations. For example, a mechanic employed by a college became noted for his use (and misuse) of very long words, a compensation which was, incidentally, transparent to all except the man himself. Parents often endeavor to secure compensation through their children, and urge the youngsters into careers that they themselves would have liked to pursue.

The results of compensation are not always unfortunate. If a child, or an adult, is prevented by unavoidable circumstances from achieving what he most desires, compensations in the forms of hobbies, collections, and other avocational interests may provide an indirect route to a passable adjustment. In not a few cases, ultimate achievement in science or in the arts may have had its origin as a compensatory adjustment of a boy who feared competition in sports. On the other hand,

compensatory reactions are often seen in the symptoms of serious behavior disorders, as will be shown in the next chapter. Compensation is not necessarily "bad" just because it is compensation. Its evaluation, as is true of all other mechanisms, depends on whether it plays an integrative or non-integrative role in the whole life of the person.

IDENTIFICATION

Another common mechanism is identification, in which a person reduces his tensions by taking as his own the achievements of a person or a group. The person "identifies himself" with another individual or with an organization. Identifications occur at all ages, ranging from a child's pride in his father's strength and knowledge, through the student's glorying in the victory of "his" football team, to the adult participation in lodges, clubs, and political parties. In most instances, identification is an integrative mechanism and a constructive influence for socialization. But it can be overdone as, at the extreme, in delusions of identity when a patient believes that he *is* a god or a king.

Identification is not chosen deliberately—nor is any other adjustment mechanism. Mechanisms are "unconscious" in the sense that the person, while of course aware of *what* he is doing, is unaware of *why* he does it. The response is hit upon, is reinforced by some form of motive reduction, and is thereby learned without any conscious deliberation.

REACTION FORMATION

One way to resolve a conflict is to strengthen one of the conflicting motives. The mechanism of reaction formation is the assertion of an attitude opposite to one that is strongly felt but which evokes anxiety. A traditional example is the child who whistles in the dark, a gay response that is the opposite of his fear and thereby helps to control it. Censorious attitudes are often reaction formations, when a person controls his temptations by aggressively asserting the opposite virtues. The reformed alcoholic is said to be the most fervent advocate of temperance.

RATIONALIZATION

As compensation is to conduct, so rationalization is to thinking. A person who rationalizes gives "good" reasons for his actions which help him to

conceal, especially from himself, some "real" reasons which would arouse anxiety if admitted openly. Almost everyone in our culture finds some need to rationalize as a defense. Common rationalizations are illustrated by the excuse-making that follows having done poorly on an examination, having been reprimanded by one's employer, or having lost a set of tennis. In these situations it is consoling to believe, respectively, that the instructor was unfair, that the mistake was made by someone else, or that one's racket must be re-strung.

While rationalization is one of the most common mechanisms of normal people, it also determines the content of many delusions. The patient who believes that he has been imprisoned in order that others may get his money is spared the pain of recognizing his own psychological disorder.

PROJECTION

As a means of defense against tendencies that he cannot admit to himself, a person may ascribe these same desires to other people. Thus a student with a strong temptation to cheat may see evidence that everyone around him is cribbing. A prudish person is sometimes one who is struggling with sex drives that cause him anxiety, hence he sees obscenity in every book and theatrical performance. The tendency to be oversensitive about one's own weaknesses and to detect them more readily in others is a common human mechanism. It also characterizes some delusions, such as the delusion of persecution. If a psychotic person is suppressing an urge to do away with his family, he may easily shift to a belief that his family is hostile and is trying to poison him.

SECLUSIVENESS

A different sort of adjustive behavior is illustrated by withdrawing or seclusiveness. Seclusive persons shun the company of others, prefer solitary amusements to competitive ones, and would rather watch than participate. These responses are adjustive, for one way to escape from painful failure is not to try. Withdrawing adjustments are tried by almost everyone who encounters thwarting in social situations, and frequently alternate with the more aggressive defenses. An anxious person may be shy and retiring at one time, and actively compensatory at another, with seeming

inconsistency. But there is real psychological consistency, because both types of behavior are attempts to cope with anxiety.

Seclusiveness may arise from a strongly reinforced fear of social situations or from the persistent thwarting of more active attempts to adjust. Many timid children have histories of harsh treatment by parents, or of demands made on them which they cannot fulfill. A child whose compensatory adjustments are suppressed punitively has no alternative but to withdraw.

Extreme withdrawing is typical in many cases of schizophrenia, the most common of the severe psychoses. There is every reason to believe that seclusiveness serves the same adjustive need in a schizophrenic as it does in a more normal person; it is a way of escaping from painful personal relationships. Seclusiveness in the earlier years does not, however, have a high degree of relationship to schizophrenia in adulthood. Many withdrawn children become seclusive adults who are not disordered and probably not too unhappy in their solitary style of life. There is a correlation between the quality of adjustment in childhood and in adult life, but seclusiveness is no more insidious than is uncontrolled, acting-out behavior

NEGATIVISM

Very vigorous and emotional withdrawing is called negativism. It is shown by rebellion, stubbornness, and resistance to social demands. The concept of negativism has three applications. It is an almost inevitable behavior of young children, a nonintegrative adjustment in some older children and adults, and a symptom found in extreme degree in some psychotic persons. Children about two or three years old show spells of negativism rather frequently. They have limited means for understanding social requirements and for coping with situations, but can assert themselves and gain attention by unreasonable refusals. Negativism is a form of anger response and is related to temper tantrums. If it is reinforced because it satisfies needs, and if unfortunate circumstances hamper the development of more integrative adjustments, the negativism may persist into the adolescent and adult years.

Some psychotic persons show marked negativism by refusing to cooperate in the hospital, refusing to eat, and sometimes by doing the opposite of whatever is demanded. Earlier normal

negativism probably has no causal relationship to the negativism of psychosis. But it has the same utility as childhood negativism, as a means of personal expression under conditions that limit the availability of other adjustive behavior.

FANTASY

To imagine the attainment of satisfactions that are not attained in real life is such an easily available adjustment mechanism that it need be no surprise that almost everyone engages in fantasy or daydreaming. Questionnaire studies of undergraduate and graduate students have shown that about 97 per cent reported that they had daydreamed during a period of a month. The most common types of fantasy reported represent the most often thwarted of common motives. Students daydream of possessing physical strength or attractiveness, of having money or possessions, of being successful in a vocation, and of securing a desired partner of the opposite sex (Shaffer and Shoben, 1956).

Daydreaming seems to be more common among anxious persons because they have greater need for it, and among the seclusive because they lack other adjustive outlets. As is true of some other mechanisms, fantasy may serve either integrative or nonintegrative functions. It is not always easy to distinguish adjustive daydreaming from constructive planning or from creative imagination. A nonintegrative aspect of fantasy in some instances is that a person who is too well satisfied in his daydreams may be less motivated to achieve his goals in reality. Fanciful delusions of some psychotics are similar to daydreams, but the patient does not recognize them as unreal.

PHOBIA AND REPRESSION

The term *psychoneurosis* designates a range of severity of behavior disorders, less integrative than behaviors regarded as "normal," but not as badly disturbed as the psychoses. No great gulf exists between normal and neurotic behavior, as the mechanisms which characterize psychoneuroses are used by almost all of us from time to time. The difference is mainly a matter of degree.

PHOBIA

A phobia is an unaccountable fear of some definite situation; an example was given in the

preceding chapter (Case 1, p. 208). One person may fear the dark, another is thrown into a panic by crowds, while others may fear cats, high places, small enclosed places, running water, eyes, and a host of other stimuli. Phobias vary greatly in intensity, ranging from a mild uneasiness in the presence of the stimulus to a severe panic which disorganizes a large segment of a person's life. The milder cases are very common, and instances of them can be found in almost every classroom group. More severe phobias, along with compulsions, obsessions and some other allied conditions, are usually regarded as psychoneurotic reactions.

Phobia as Conditioned Fear (Case 10). A classical case of phobia was reported by Rivers (1917), a British psychiatrist, from his experiences in World War I. The patient was a young physician who had suffered throughout his life from an intense fear of enclosed places (a so-called "claustrophobia"). He experienced panic when in a small room with the door closed, and was unable to attend the theater because the exits seemed to be blocked by the crowd of people. In the war he had such a fear of enclosed shelters that he preferred to be in an open trench under fire. The wartime experience made him realize that his fear was abnormal and he sought help. Typically, the fear was unaccountable to him and he could remember no experience that might have caused it.

In treatment, Rivers taught the young man to make "free-associations" about his fear, that is, to engage in relatively uninhibited reverie about how he felt and what it reminded him of. After several sessions, he suddenly recalled an incident that had occurred when he was about four years old. He had found a piece of junk and had sold it to a junk dealer. On leaving, he went through a dark passage only to find the door to the street shut. A dog in the passageway began to growl, and the child was terror-stricken and frantic in his attempts to get out. He had not recalled the incident since early childhood but had suffered from the phobia and from terror dreams of being confined. After the experience had been recalled and discussed, the intensity of his phobia and dreams diminished greatly.

In relatively simple cases such as the Rivers case, the easiest feature to explain is the source of the fear of a particular stimulus. It is a strongly reinforced conditioned fear reaction, analogous to

conditionings that are readily produced in the laboratory. If a person fears dogs, or high places, or the dark, it is often because a strong fear was evoked at the same time that the stimulus occurred. A more extraordinary feature, and not so easily solved, is the strange forgetting of so intense and significant an experience. The recall of the incident is said to be "repressed," an important concept which we will consider presently.

Phobia as Displaced Anxiety. Other cases of phobia develop by a somewhat more complex process. Masserman (1961) reported the origins of a phobia for dogs and other small pets shown by a girl eighteen years old. (Case 11.) Anne had been an indulged only child until she was supplanted by a younger brother when she was four. As is not rare in such instances, Anne was openly jealous, but gave up her hostile behavior toward the baby when her parents punished her for it. The parents then gave her a puppy so that she would have "a baby of her own" but she abused it so badly that it died. The parents, perhaps recognizing her implicit motivation, now punished her severely with the result that Anne became generally anxious and "nervous," and developed a phobia of pets.

It is evident that Anne had not been attacked or frightened by the little animal. Why, then, did she become afraid of dogs? Such a phobia is interpreted as a result of two stages of learning. First, because of the reinforcement provided by her parents' rejection and punishment, Anne came to fear her own hostile thoughts toward her baby brother. Second, the puppy was intimately associated with the incident, so that seeing the puppy reminded her of her own hostile act and thereby evoked anxiety. The fear of pets, in fact, provided Anne with a mechanism that helped to control her anxiety. By "blaming" her fear on the dog, she kept herself from recognizing its real source—the fear of her own hostility. Anne's behavior illustrates the mechanism of *displacement*, which is the substitution of a less threatening stimulus for a more threatening one. It was less anxiety-evoking for Anne to fear pets than for her to fear her desire to injure her brother.

COMPULSION AND OBSESSION

A *compulsion* is a strong impulse to perform, often repeatedly, an act that has no practical utility. Persons who have a compulsion realize that

the behavior is absurd yet cannot curb the impulse. Anxiety mounts until it is reduced by the compulsive act, only to rise again. Compulsions often accompany phobias, to which they are related psychologically. A woman who had a phobia that something horrible was back of her also experienced a compulsion to search her room at frequent intervals although she knew rationally that no one else was there (Bagby, 1928). The compulsion had an adjustive effect; it reduced the anxiety of her phobia.

An *obsession* is a recurring thought that a person cannot prevent, even though he knows that it is silly, meaningless, or useless. For example, a girl who had a phobia for eyes also was obsessed with the phrase "fear looking out of her eyes," which kept running through her thoughts (Shaffer & Shoben, 1956). A business man had an obsession that his two children, really safe in a private school, might be in some danger, which he reduced by compulsive telephone inquiries three times a day (Masserman, 1961). In many instances an obsessive concern is like a reaction formation: a person disowns a hostility of which he feels guilty by showing an obsessive solicitude. But not all obsessions are to be taken seriously. They have their counterpart in normal life, as do all mechanisms of adjustment. "A tune running in one's head" is a familiar obsession that happens to almost everyone.

THE MECHANISM OF REPRESSION

Repression is the most generally interesting phenomenon found in phobias, compulsions, obsessions, and in some other behavior disorders, too, as we shall see. It is inconceivable to common sense that impulses and experiences which exert so profound an influence on a person's life could be "forgotten." There is ample evidence, however, that repression does occur. The case histories of persons who suffer from phobias offer clear indications of its presence. Even more convincingly, many experimental studies with normal people show that there is a general tendency to forget experiences which evoke anxiety or which are regarded as unworthy, shameful, or guilty.

Repression is interpreted most satisfactorily as an *inhibitory adjustment*. In many situations of everyday life, persons adjust by *not doing* (inhibit-

ing) an act that has painful consequences. A burned child adjusts by not touching the hot stove. An older person may adjust to a social rebuff by withdrawing, that is, by inhibiting his normal tendency to seek companionship. In Laboratory studies, a "negative reinforcement" is a painful effect such as an electric shock contingent upon a response, the dependable result of which is the cessation or inhibition of the response.

Quite similarly, a person may adjust to a painful event in his past life by inhibiting a recall of the event. The recall of such an experience tends to evoke anxiety. To prevent the anxiety and thereby maintain adjustment, the process of inhibition or of "not-recalling" occurs. Recall is an act, a response to a stimulus, and is just as susceptible to inhibition as any muscular activity. The mechanism of repression is therefore compatible with principles of general psychology and with evidence from the laboratory. Repression, of course, is not deliberate or consciously intentional. In fact, it is rather hard to forget something "on purpose." But if a past event is painful enough it is likely to be repressed by an inhibitory adjustment which, like other mechanisms, is impulsive and not governed by rational deliberation.

The mechanism of repression is especially non-integrative because it leaves the person unaware of a vital segment of his experience. He is thereby prevented from using all of his life data consciously in evolving rational solutions to problems. Repression causes a phobia to persist because it prevents the victim's fear from being reduced by reconditioning. To cure a child's fear of a real dog, he may be reconditioned by having pleasant and unfearful contacts with the dog. But if he fears an event long past, his reconditioning has to proceed verbally, by talking about the fearful experience and learning to make a new adjustment to it. For reconditioning to occur, it is essential that the stimulus for the fear be present, either actually or in the substitute form of words and ideas. When the words or ideas are repressed, reconditioning is rendered more difficult. The reinstatement of the repressed recall through psychological treatment enables the person to learn new, and usually more integrative, responses to the source of his fear. This is why the recall of the repressed experience which conditioned a phobia is often a useful step toward recovery.

INACTIVATION AND DISSOCIATIVE REACTIONS

INACTIVATION REACTIONS

Among the most severe and striking of psychoneurotic reactions are those evidenced by symptoms such as paralyses, anesthetics (losses of sensation), and pains. Untrained observers, and most of all the patient himself, believe that such symptoms always arise from organic causes as indeed they can, but the evidence that they may also have psychological origins is conclusive. The symptoms usually involve a limited part of the body—a paralyzed leg, a numbness of the hand, or a constriction of the throat muscles. One illustration has already been cited briefly (Case 2, p. 208); let us consider another.

A Case of Inactivation Reaction (Case 12). Kate F., a very attractive young girl thirteen years of age, was admitted to a hospital suffering from a partial paralysis of the left leg, extreme nervousness, and marked loss of appetite. Several months before, while she was in school, her left leg suddenly "gave way," felt numb, and had a tingling sensation of "pins and needles." She was confined to bed at first, then used crutches for a time, but made a partial recovery during the summer months. Upon starting school again in the fall, the symptoms recurred and she was brought to the hospital. Careful medical examinations indicated that there was no organic disorder of the nervous system to account for her condition.

In a series of interviews with a psychologist the history leading to her attack was brought to light. After much hesitation, she tearfully related the story of a triangle situation involving her parents. Three years previously, her mother and a roomer in the home fell in love and eloped. The father and sisters found her mother and brought her back home. Then for many nights there were violent and abusive scenes, as the father upbraided the mother, and she in turn also accused him of infidelity. Kate reacted to these scenes with crying and praying, and felt that she had lost all faith in her beloved parents. Other quarrels followed for some time, but at last the parents assumed an outward calm for the sake of the children. Kate continued to brood over the situation, however, and began to avoid the company of other children. She often stayed in during recess at school rather than face the other girls. It is notable that the leg

paralysis appeared just before a recess period. In a long series of talks over many months, the psychologist made the girl tell the story of her parents' conflict over and over again. Gradually, Kate came to accept it as a misfortune that was entirely in the past and no longer a source of fear. With the assimilation of the experience, her symptoms disappeared (Carter, 1937).

The Interpretation of Inactivation Reactions. There are two things to explain about a case of inactivation reaction. One is the underlying disturbance of personality and the other is the origin of the particular symptoms shown. A person who suffers from an inactivation response is said to show the mechanism of *dissociation*, being fragmented or lacking in unity of behavior. The paralyzed member is, so to speak, dissociated or shut off from the total integrative behavior of the person. An individual with a paralyzed arm, for example, quite literally "does not let his left hand know what his right hand is doing." Dissociation may occur, among a number of alternatives, as an adjustment to inharmonious and conflicting reactions toward a situation. Kate F. illustrates this generalization aptly. In earlier life she had learned to love and idealize her parents; now she finds them unworthy. She continues to live with them and outwardly to respect them, but in a deeply emotional but only vaguely understood way she is disillusioned, repelled, and disgusted. Thus she learned to divorce her overt behavior from her emotional attitudes, which is the essence of dissociation.

The particular inactivation symptom has utility as a mechanism for controlling anxiety, for it is a partial, nonintegrative adjustment. For example, Kate wished to avoid contacts with her fellow pupils because of her feeling of shame, and had already tried the simple defense mechanism of seclusiveness. The paralyzed leg provided a perfect excuse for withdrawing from company, and so was adopted or "learned," her already established mechanism of dissociation permitting this irrational solution. The particular symptom in most cases of inactivation reaction is *suggested* by some real, minor, and temporary organic condition. In Kate's case, it is very probable that her leg "went asleep," a common condition due to pressure that everyone experiences from time to time. Most persons take the leg "asleep" calmly and stamp or move it until it is restored. But

anxious Kate, ready to believe the worst about herself and desperately needing a way out, is prepared to perceive the paralysis as serious and enduring.

An inactivation reaction is not a pretended or imaginary disability but a very real one that arises from psychological causes. The affected person is unaware of the source, nature, and utility of his symptom. It first occurs almost by chance, as in Kate's case, is strongly reinforced by its effect in reducing anxiety, and is thereby maintained. Its relation to the mechanism of repression is of interest; an inactivation is an inhibitory response of a part-system of the body just as repression is an inhibition of impulse and recall. When the patient, with help, evolves a more integrative adjustment to his major conflict, the inactivation usually disappears.

Common Dissociative Reactions. Dissociative and inactivation reactions are very common non-integrative adjustments if the less striking cases are considered. A housewife, anxious because she is neglected, may develop "sick headaches" that satisfy her needs by evoking the sympathetic attention of her family. Vomiting is not an infrequent reaction to stress made by young children, and sometimes by adults as well, which is adjustive because other people then perceive the child or person as "sick" and needing help instead of as "bad" and deserving punishment. Vomiting seems very physiological, but it is a reflex that can readily be conditioned to psychological stimuli. Another familiar example is the "nine o'clock headache" by which a child may escape the anxiety-arousing threat of being sent to a school to which he is ill-adjusted. Disabilities that arise from industrial accidents and automobile collisions are occasionally psychological, originating from the fear induced by the situation rather than from organic injury. Because inactivation reactions may simulate almost any bodily disability, laymen cannot distinguish them reliably and even general practicing physicians sometimes mistake their diagnosis. Experienced psychiatrists can understand most cases, from the pattern of the symptoms, the course of development, or the effects of psychological treatment.

Some Antique Terminology. The dissociative reactions were for centuries called "hysteria," a term which originated in ancient times and has passed from official nomenclature only in the past decade

or two. Thus the conditions described in the preceding paragraphs have until recently been called "hysterical paralysis," "hysterical pain," and the like. The word "hysteria" comes from the same Greek root as the word uterus, and its use implied that such conditions were female complaints vaguely related to sexual functions. Only in the nineteenth century was it generally recognized that men, too, can develop this type of mechanism. Another obsolete term was derived from a nineteenth-century concept that inactivation reactions arose when a mental conflict was "converted" into a physical symptom, a statement now regarded as having no explanatory value. Using this discarded theory, Kate's paralysis would have been designated as a "conversion symptom" or as "conversion hysteria." Old terms die hard and these obsolete words are still met in current writings, but it may be predicted that their use will decrease and ultimately disappear.

SOMNAMBULISMS AND FUGUES

More severe and less common degrees of dissociation are found in somnambulisms and fugues. In *somnambulism*, which literally means "sleep walking," an individual goes into a trance-like state in which he re-enacts a scene that occurred in an emotional crisis. A pioneer description of a somnambulism was the case of Irene, a twenty-year-old French girl. (Case 13.) Irene's mother had died under most harrowing circumstances. For some time afterward, Irene would occasionally go into a trance-like condition in which she would re-enact with great manifestations of grief the scene at her mother's death, and her own subsequent attempted suicide that she had planned but had not carried out. During the somnambulism she was entirely oblivious of her surroundings, talking with her mother as if she were present, and ignoring anyone else. Between attacks, on the other hand, she showed no grief about her mother and went about her ordinary business normally. She had entirely dissociated her mother's death from the rest of her experience, reserving it for the special episodes (Janet, 1907).

A *fugue* is a prolonged somnambulism during which a person forgets his identity, and often travels to a different place. After some time the individual usually "comes to himself," does not know where he is, and remembers his past life but not the period of the fugue. The fugue, there-

fore, is a temporal segment of his experience that is almost entirely dissociated from the rest of his life. The chief symptom of a fugue is termed *amnesia*, which means a loss of memory. This disorder is not especially rare, and cases of it are reported in the newspapers from time to time. The "amnesia victim" is found wandering in the streets and regains his former character gradually after he has been identified and restored to his family. A fugue is usually precipitated by an intense emotional crisis, toward which it has two adjustive functions. First, the individual spares himself from harrowing thoughts by forgetting all of his past; and second, his flight is a withdrawal from the stimuli that stir up his emotion.

MULTIPLE PERSONALITY

The most extreme form of dissociation is found in *multiple personality*, a disorder that is an exaggerated, alternating, and long-continued fugue. One case citation will make this condition more clear than many paragraphs of description.

A Case of Multiple Personality (Case 14). Mrs. X had shown severe dissociative symptoms throughout childhood. She had fainting spells, somnambulistic episodes, pains, and paralyses. At times her arm would hurt, again she had a stiff leg, and on one occasion she could not walk for two months. She was in constant conflict with her father, who punished her severely. Largely to escape an unhappy home she married a young man who was disapproved by her parents. Her husband was exacting, however, and she soon was weighted down with the domestic responsibilities of a baby. It was to escape these burdens that the first secondary personality appeared.

The secondary personality, which the psychiatrist named "Susie," was a mischievous and irresponsible childlike character. At times Mrs. X was a normal mother, at other times for hours or days she was "Susie," neglecting her housework for play or for wandering about the streets. Her infant died of neglect during one of these periods. "Susie" was unknown to the normal Mrs. X (amnesia), but "Susie" wrote notes in which Mrs. X was referred to as "she." "Susie" never spoke and was almost entirely insensitive to pain. Later, this patient developed two other secondary personalities. One, called "Jack" was a masculine character into which she would pass occasionally. At one time she was "the Baby," acting for sev-

eral weeks as if she were an infant about one year of age. It is interesting to note that this patient became quite normal several years later, partly through psychiatric treatment, and partly because of her removal to a remote mining town where her responsibilities and conflicts were minimized (Wholey, 1933).

ANXIETY AND ITS EFFECTS

Anxiety lies at the root of almost all inadequate adjustments. The adjustment mechanisms so far described—from simple compensations to extreme repressions and dissociations—originate from conflicts and are reinforced because they reduce anxiety. But what if a person is unable to discover a way to resolve a conflict, either integratively or by the use of one of the substitute mechanisms? He then remains in a state of being anxious and suffers the misery of unreduced distress.

Anxiety, of course, exists in all degrees of severity. A little unreduced anxiety is a common experience of everyone and may even be a useful drive that spurs us to get things done. At the other extreme, very severe anxiety states are among the most distressing experiences known to mankind. The extent to which a mechanism reduces anxiety may also vary in degree. Many mechanisms are partly successful; they are serviceable in helping to control anxiety but do not eliminate it entirely. Persons who are seclusive and daydream secure partial adjustment but usually feel anxious at the same time. Even an individual who compensates aggressively and thereby appears brash and confident on most occasions may have other spells of being self-depreciative and depressed. Adjustment is therefore not an all-or-none matter; some degree of tension reduction by adjustment may exist along with some degree of residual anxiety.

COMMON ANXIETIES

Anxiety which arises from realistic and immediate causes is a commonplace experience. A student often feels anxious when waiting outside the dean's office for a potential reprimand, or when he knows that he is insufficiently prepared for an examination. Common anxiety is often designated by two words that are not technical terms in psychology but are understood by everyone. The anxious person is popularly described as "worried" or "nervous."

"Worry" is a process of persistent nonintegrative thinking. The worrier is preoccupied with his troubles and has an intense drive to do something about them but can find no solution. He recounts his woes over and over, mainly in implicit speech to himself and sometimes aloud to anyone who will listen. Worry about an impending threat may end when the problem is actually solved or, less fortunately, when some substitute mechanism is hit upon which reduces the tension. Thus worry may be relieved nonintegratively if the worrier rationalizes that he is not at fault, or projects his rejected impulses on other persons.

Repression and displacement are involved in many persistent cases of worry. If a person cannot admit to himself the real cause of his anxiety he may displace the emotional reaction to all sorts of other situations.

(Case 15). A young man was prevented from solving his normal adolescent problems of establishing his independence and of social and sexual adjustment, mainly because of his relationship with his father who had always held him under strong domination. The youth repressed his hostility toward his father and, indeed, repeatedly told how good his father had been to him with a fervor that suggested the mechanism of reaction formation. He developed widely displaced worries about his health, his studies, and his social relationships. The young man's behavior illustrates the co-existence of partial adjustment and residual anxiety. His repression, reaction formation, and displacement helped him to cope with his attitude toward his father but he was still anxious. When a worry is disproportionate to its apparent cause, some concealed reason for it may be suspected.

"Nervousness" is a layman's word and has no precise psychological definition. Most often, however, it refers to a common condition of sustained muscular tension that evidences an unreduced anxiety. The "nervous" person cannot relax; he is tense and shows many kinds of restless movements. Small distractions such as monotonous noises annoy him excessively and he is too much startled by any sudden stimuli. Along with these muscular symptoms, a "nervous" person often shows visceral signs of emotion such as spells of racing heart beat and interferences with digestion. He may also suffer from worry and indecision.

A common misconception of ordinary "nervousness" holds it to be an organic disorder vaguely

attributed to "weak nerves." It is true that an ill person may be "nervous" because he is anxious about his health, and that some endocrine gland disorders are characterized by restless hyperactivity. Most "nervousness" has no such organic basis, but is a type of anxiety response to an unsolved conflict. Like "worry," "nervousness" may be a response to an immediate threat, or may be a generalized reaction to a situation that is unidentified because of repression. In the latter instance, the person does not know why he is nervous," which adds to his burden of woe.

"Worry" and "nervousness" cannot be treated directly. Reassuring the sufferer that there is no real cause for his distress does not make him feel better because he knows that he is miserable, and if he is miserable without a real cause he must be queer indeed. Realistic common anxieties are reduced when the conflicts that evoked them are solved. Persons with long sustained anxieties involving repression and displacement often benefit from professional psychological help.

ACUTE ANXIETY STATES

Acute anxiety states differ from the common anxieties only in degree. The distinction is an important one, however, because a severe anxiety state may be one of the most disabling of all the psychoneuroses.

(Case 16.) A young soldier had been anxious in civilian life, unable to tolerate quarrels or fighting. In the North African campaign of 1943, his tension mounted as he neared the front, but he kept himself under control. On the first day under actual fire he began to tremble, was nauseated, and wandered about not knowing what to do or where to go. On admission to a hospital, he had persistent tremor, was restless and extremely apprehensive. He continually watched the skies for aircraft. Sleep was disturbed by dreams of being in the battle. After a few weeks of treatment, he improved enough to be assigned to noncombat duty (Grinker & Spiegel, 1943, pp. 34-37).

In this case, the acute anxiety state was precipitated by a minimum exposure to real danger, in a young man who already had severe conflicts relative to aggression. Other soldiers with more favorable early backgrounds sometimes developed very similar conditions of anxiety after more severe situational stress, as in the instance of a fairly stable young soldier who had a most harrowing

experience, covering himself with the bodies of his dead comrades to escape injury from shell fire.

In civilian life, acute anxiety states show a similar symptom picture, with great apprehension, trembling, and visceral disturbances. It usually follows some traumatic event or conflict, with which the personal resources of the individual are unable to cope.

EFFECTS OF CHRONIC ANXIETY

A feature of any strong emotional response is a disturbance of the circulatory, respiratory, glandular, and digestive systems coordinated by the sympathetic or thoracico-lumbar division of the autonomic nervous system. In acute anxiety there is a perception of a fluttering or throbbing heart beat known as palpitation, irregular and disturbed breathing, excessive perspiration, and interference with digestion. These responses are termed *visceral*, which means that they pertain to the inner organs of the body. But the heightened tonus of acute emotion is exhausting, as all of us notice in the aftereffects of any sudden fright. Intense emotion cannot be maintained for long without being succeeded by fatigue, lassitude, unwillingness to exert effort, and subjectively uncomfortable visceral complaints. It is therefore no surprise that a chronic anxiety state is in large part the converse of an acute one. Chronic anxiety conditions include two traditional psychoneuroses, the *asthenic reaction* or fatigue state, and the *hypochondriacal reaction* which is characterized by vague visceral discomforts not due to any identifiable organic pathology and an over-concern about one's health. These reactions are by no means separate but are often found together in a chronically anxious person, as the following case illustrates.

(Case 17.) In her senior year at college, a young woman developed a moderately severe fatigue reaction. She was always tired and any minor exertion, whether physical or intellectual, seemed too much for her. Loss of appetite, digestive distress, and constipation also concerned her unduly. She could not sleep until the small hours of the morning and then often overslept her morning classes. The college physician could find no organic basis for her complaints and suggested only a regimen of diet and activity. In her childhood and earlier youth she had been a somewhat overprotected girl who had grown up solitary, bookish, and rather

lacking in social skills. A few months ago she had fallen in love for the first time but found herself in a severe conflict between her amative impulses and her rather prudish attitudes which had developed earlier, perhaps as a compensation for her lack of success in attracting boys. The man, perplexed by her vacillation between loving and lecturing, jilted her. Her confidence in herself was threatened severely and, after a brief acute panic, she developed a chronic anxiety state. The young woman also faced other unsolved problems of late adolescence, of choosing a vocation and of becoming personally independent after graduation. Her reaction to all of these was a hypochondriacal-fatigue state of moderate intensity (Shaffer & Shoben, 1956, pp. 287-289).

Much more severe asthenic and hypochondriacal states may be observed in other cases. Some fatigue reactions are so intense and prolonged that the person becomes a psychological invalid, demanding constant care from his family. Some cases even are hospitalized. Chronic hypochondriacal reactions are illustrated by the numerous persons who constantly complain of ill health and go from one physician to another vainly hoping for a confirmation of their self-invented diagnoses. They are great users of patent medicines. Sometimes they even succeed in having useless surgical operations performed with the hope of relieving distresses that subjectively are genuine enough but which they misidentify as organic.

Hypochondriacal and asthenic reactions originate mainly from the visceral features of chronic emotional responses. As such, they are indicators of a lack of adjustment. But they also are sources of minor adjustive satisfactions that are known as *secondary gains*. The hypochondriac makes people pay attention to him, and rationalizes his failures on the grounds that he is a weak, ill, and disabled person who needs love and protection. Such gains tend to reinforce the reaction and perpetuate it. Because hypochondriacs annoy other people with their demands for attention and special privileges, they are likely to be scorned as having "imaginary" ailments. Such rejection makes them all the more anxious and is likely to augment rather than to relieve their distresses. The chronic anxiety reactions must be understood as very real psychological conditions, not as pretenses by which the patients seek deliberately to achieve selfish ends.

SOMATIZATION REACTIONS

Many features of anxiety states are clearly physiological in nature, even though they originate from unresolved psychological conflicts. Another type of response to anxiety goes one step further and involves structural damage to bodily tissues. These *somatization reactions* include peptic ulcer, mucous colitis, essential hypertension (a type of high blood pressure without other organic cause), tension headache, and a number of allergic reactions. The less satisfactory term "psychosomatic disorder" also refers to these conditions but it is faulty because it implies a dualistic premise that mind (psyche) and body (soma) are separate entities.

Physiologically, peptic ulcers are caused by an assault on the muscular tissues of the stomach by the strongly acid digestive secretions. A normal stomach is protected from the action of the acid by a mucous lining. Several effects of emotion may lead to ulcers: damage to the mucous by circulatory changes in the stomach walls, excessive stomach motility, excessive acidity of the secretions, or the retention of the juices for too long a time because of a spasm of the pylorus, the outlet valve of the stomach. These changes may occur in emotional reactions of anxiety, hostility, or resentment; they are unlikely in states of depression or grief. Peptic ulcers seem to occur most often in busy, highly motivated men who do not have other expressions of their conflicts, but they are not limited to persons of aggressive character and may be found in some apparently meek individuals whose hostility is thoroughly repressed.

Research has not yet disclosed any dependable explanation as to why some persons develop ulcers when under stress, while others show defense mechanisms of various types or else succumb to open anxiety. Constitutional factors are not entirely ruled out, but most theories emphasize the individual's life history as a main determiner of the kind of response he will make to conflicts and their resulting anxiety.

Other somatization reactions, as is true for peptic ulcer, occur in bodily systems that are affected by the autonomic phenomena of strong emotion. Essential hypertension is related to the circulatory changes typical of emotion. Observations of the flushing, paling, or perspiring of the skin in normal emotion give clues as to how the skin disorders of neurodermatitis may arise from anxieties.

The study of somatization reactions has given rise to a wider consideration of the relationships between organic diseases and psychological adjustment. Anxiety hampers recovery from many bodily ills, while confident attitudes and a "fighting spirit" have been well documented as aids to the treatment of organic diseases and injuries. Such observations break down the barriers between the physiological and the psychological, and encourage physicians to consider the patient not merely as a case of illness but as an integrated human being.

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- See Ch. 14, p. 241, for suggested readings on behavior disorders.

CHAPTER 14

Abnormal Behavior: The Major Behavior Disorders

Psychoses, to which passing reference has been made in the two preceding chapters, are the most serious of the behavior disorders, so severe and inclusive in their effects that the patient is often unable to make most of the adjustments demanded by everyday life. Many psychotic persons are treated in psychiatric hospitals, although others are cared for at home. A recent development is that some patients, while remaining basically psychotic, can achieve a limited role in society and even work productively, a triumph made possible by new methods of treatment. The psychoses are approximately equivalent to "insanity," but the latter term is a legal one, implying an inability to manage one's affairs prudently, and has no precise psychological definition.

For many years it has been customary to classify the major behavior disorders into two groups, the *organic psychoses* and the *functional psychoses*. The organic disorders have identifiable pathology of the tissues of the brain, due to impaired tissue nutrition, infectious diseases, drugs and poisons, accidental injuries, neoplasms (tumors), and other anatomical and chemical causes. In contrast, the functional psychoses are not associated with any such obvious tissue damage, although a possible role of more subtle physiological changes is by no means ruled out.

ORGANIC PSYCHOSES

A common characteristic of all organic psychoses is *intellectual deficit*, a generally irreversible impairment of the abilities to remember, discriminate, and reason. The extent or degree of the deficit varies greatly, of course, according to the scope of the brain damage and the stage of the disorder. The quality or nature of the deficit varies too, mainly with the location and severity of the tissue injury which differs from one psychosis to another. Another important consideration is whether the condition is *acute* or *chronic*. The acute conditions caused by sudden and massive brain changes are likely to be accompanied by convulsions, delirium, and loss of consciousness. The chronic, slowly developing, conditions are

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less spectacular and more insidious, with a gradual impoverishment of attention, memory, thinking, and orientation. Chronic intellectual deficit is often called *dementia*, a term signifying a loss of "mind," that is, of the higher intellectual functions.

SENILE AND ARTERIOSCLEROTIC PSYCHOSES

Senility is a process of deterioration of the organs and functions of the body. It occurs in the elderly, of course, but is imperfectly correlated with sheer chronological age. Some persons show signs of senility at an age as young as sixty while others live quite unaffected into the nineties. The onset of senility is influenced by constitution, by variations in nutrition, by diseases, and apparently by psychological factors such as the continued active interest in an occupation and in avocations. Because the control of infectious diseases has lengthened the life span, more people live long enough to become senile. As a result, the senile psychoses are today the most prevalent of behavior disorders, accounting for as much as 40 per cent of admissions to psychiatric hospitals in some urban areas, twice the rate of a generation ago.

In an uncomplicated senile psychosis, the brain loses weight, the convolutions become shrunken, and nerve cells atrophy. The first behavioral symptom is usually a deficit of immediate memory. The defect may be more of learning than of retention, as shown by senile persons who can tell of their childhood in detail but cannot remember immediately past events. With further progression, even long-known events may be lost and the senile person does not recognize familiar persons, or know his name, his age, or his former occupation.

While many senile patients are contented and cheerful, others show behavior that makes them hard to live with. It is often noted that senility brings an exaggeration of life-long trends of personality. Some patients are selfish and irritable, others become depressed. Occasional delusions occur, in which a patient believes that his family has imprisoned him or is trying to poison him in order to get his money. Such delusions usually develop in persons who have been suspicious and distrustful in earlier years. Thus senile psychoses illustrate the typical interaction between organic and psychological factors when the mounting intellectual deficit releases personality trends formerly held under more rational control.

Arteriosclerosis, the hardening of the arteries,

is somewhat related to the process of aging and complicates many cases of senile psychosis. Its effect is due less to the hardening of the artery walls than to the narrowing of the tube within the blood vessels. The resulting shortage of oxygen affects the metabolism of the brain severely. Cerebral arteriosclerosis may occur in persons much younger than the senile years, typically between 50 and 65. Because they are as yet unreconciled to the concept of being elderly, they recognize their decline and are likely to react to it with compensatory mechanisms that appear as changes of character. A person who suffers from cerebral arteriosclerosis, whether senile or younger, is likely to have "strokes" from ruptures of the arteries which cause blood clots to exert pressure on the brain tissues. Large, localized cerebral hemorrhages may cause organic paralyses or aphasia (Case 8, p. 212). Numerous small ones evoke immediate symptoms of confusion and delirium, followed by accelerated deterioration.

ALCOHOLIC PSYCHOSES

The ingestion of alcohol has many effects on the body but especially on the nerve cells of the brain, giving rise to a number of behavior disorders.

Intoxication. Ordinary intoxication is itself a psychosis, although a fortunately temporary one. The mildly intoxicated person becomes genial and happy (euphoria), and shows excitement and flight of ideas. With more alcohol he may show an exaggeration of his already-established personality traits, becoming boastful, aggressive, suspicious or sad. Normal inhibitions of conduct are weakened, the person remembers poorly, and finally lapses into a stupor. The condition would be regarded as a very serious behavior disorder except for the speed with which persons recover from it.

The repeated and excessive ingestion of alcohol often functions as an adjustment mechanism. Alcohol is a reducer of anxiety, hence its use brings repeated reinforcement. Alcoholism is therefore not only a physiological addiction but a psychological mechanism as well. A permanent relief from alcoholism is rarely achieved by physiological measures alone; it is necessary also to treat the conflicts that made the man take to drink.

Chronic Alcoholic Psychoses. Continued alcoholism over a period of years usually causes irreversible changes in the nervous system. The be-

havior symptoms include tremors, loss of memory, and some degree of intellectual deficit. The chronic alcoholic has poverty of ideas, his judgment is poor, and his reasoning is defective. Emotionally, he is likely to be indifferent to the opinions and feelings of others, but irritable and impulsive when his own acts meet with interference.

Delusions often appear in deteriorated alcoholic psychotics, just as they do in other patients whose rational appreciation of reality is impaired for any cause. Delusions of self-accusation and unworthiness are understandable and almost realistic. Other frequent delusions are that the patient's wife is unfaithful to him or that his family persecutes him. Such delusions seem classic examples of projection. Repressing a recognition of his own faithlessness, the alcoholic defends himself by believing instead that his family is unfaithful to him.

Acute Alcoholic Psychoses. A chronic alcoholic may have acute psychotic episodes, precipitated either by a prolonged spree or by a sudden withdrawal of the drug. One of the best known is *delirium tremens*, a very acute condition of short duration. The most prominent symptoms are extreme irrational anxiety and visual hallucinations of terrifying snakes, rats, insects, and more fantastic creatures. Tactile hallucinations of insects crawling on the skin are not rare. The patient trembles, is restless and excited, and cannot sleep. The course of the psychosis is run in three to ten days.

Alcoholic hallucinosis is a different type of acute episode which may occur in chronic alcoholics. The hallucinations are characteristically auditory and consist of insulting, accusing, and threatening voices. There is less clouding of consciousness than in *delirium tremens* but the duration of the disorder is longer.

A condition of special psychological interest is *Korsakoff's psychosis*. Usually occurring in alcoholics, it is specifically related to a deficiency of vitamin B, from which chronic alcoholics often suffer because they neglect their diets. In addition to agitation and anxiety, the patient has a striking loss of memory. To fill the gaps that he cannot recall, he "romances" about supposed experiences. A patient who has been in a hospital for days, for example, will give an account of a play that he saw on the preceding evening or of a conversation he had with friends. The fictitious memories are compensatory mechanisms which help the

patient repress the recognition of his intellectual deficit.

Other Drug Psychoses. Alcoholic psychoses have been chosen for extended description because they are the most common and best known, but many other drugs and toxic substances have severe psychological effects. The addictive drugs—morphine, cocaine, heroin, and the like—may precipitate acute psychosis when they are withdrawn and chronic symptoms with long continued use. Many common drugs and poisons—barbiturates, bromides, lead compounds, carbon disulfide, and others—are each associated with a distinct psychological disturbance, mainly because they disturb the metabolism of the brain.

SYPHILITIC MENINGO-ENCEPHALITIS

The principal psychosis caused by an infectious process is syphilitic meningo-encephalitis, still often called by its former name, "general paresis." A case has already been described (Case 9, p. 213). Its diagnosis is based in large part on a typical sequence of behavioral symptoms, but even more on serological tests which indicate the presence of the spirochete of syphilis in the cerebrospinal fluid. About 2 per cent of patients admitted to psychiatric hospitals have this disease; a generation ago it was four or five times as common.

Syphilitic meningo-encephalitis typically begins in middle life, ten to twenty years after the initial infection. In the early period of development, failing memory and judgment may cause the individual to make blunders in his personal, business, or professional affairs. His moods are erratic and he may be foolishly optimistic at one time and deeply depressed at another. Alcoholic and sexual episodes are not rare, a fact that caused the disease to be ascribed to "depraved character" in the last century when its syphilitic origin was not known.

If the psychosis is not checked by treatment, a fully developed stage evolves gradually. The symptoms are now unmistakable. The patient usually develops a stumbling, incoordinated manner of walking and his voice is thick. Most patients have convulsions from time to time caused by sudden tissue changes in the brain. There is increasing intellectual deficit and disorientation. In the fully developed stage, unsystematized delusions are common. They seem most often to be expansive and grandiose but sometimes are depressed

and melancholy. Untreated syphilitic meningo-encephalitis progresses to tremor, emaciation, complete dementia, and death.

Years ago it was found that drugs reasonably effective for treating primary syphilis did not cure the cerebral infection. The fever treatment, which by various means raised the patient's body temperature for prolonged periods, was a standard and moderately successful method of therapy for many years. In 1943, it was discovered that penicillin is as effective against cerebral syphilis as against the primary disease, and it is now the universal and generally successful remedy. Syphilitic meningo-encephalitis can be prevented by the continued and effective treatment of primary syphilis, if infected persons are diligent in having continued spinal fluid tests and courses of penicillin. It is conceivable that this once prevalent scourge may disappear in a generation.

CONVULSIVE DISORDERS

About one person in two hundred in the general population suffers from a behavior disorder characterized by episodic convulsive seizures and caused by abnormal physiological processes in the cerebral cortex. Formerly called *epilepsy* and regarded as a single disease, the convulsive disorders are now interpreted as a group of conditions arising from similar tissue pathology. The classic symptom of epilepsy is the *seizure* which usually begins with preliminary signs such as flashes of light, subjective sounds, or vaguely uncomfortable sensations of the skin. Next, the patient becomes rigid, falls, and loses consciousness. After some seconds, the convulsions begin as intermittent contractions of the skeletal muscles. Movements of the mouth whip up a foam of saliva, and the tongue may be bitten during the convulsive jaw movements. A typical seizure lasts a few minutes, after which the patient remains unconscious for a time although relaxed. The person is usually fatigued and depressed after a seizure.

Convulsive episodes vary greatly in intensity and frequency. Mild seizures may appear only as a shudder and a momentary lapse of consciousness. The number of seizures may vary from a few in a lifetime to several a day. A rare and extreme condition is *psychomotor epilepsy* in which a person shows delirium, confusion, great excitement, and sometimes outbursts of great violence. Only this

latter degree of epilepsy may be regarded as psychotic.

The understanding of epilepsy and its diagnosis have been aided greatly by the *electroencephalogram* (EEG), first perfected in 1929. The EEG records variations in the electro-physiological activity of the brain from electrodes placed on the outside of the head. The EEG's of epileptics are distinctive in the rate, intensity, and irregularity of the electrical discharges. The abnormal electro-physiological activity is due to a variety of causes. For some cases a relevant hereditary factor seems to be present, since relatives of epileptics tend to have deviant EEG's even if they are free from seizures. In other instances, localized damage to the brain was caused originally by injuries, inflammations, or tumors.

Recent years have seen great progress in the treatment of the convulsive disorders. While not curing the cause of the condition, new anticonvulsant drugs keep the seizures under such dependable control that most persons formerly regarded as epileptics can pursue normal occupations and some even drive automobiles safely. A generation ago most states had institutions for epileptics; now their buildings have been converted to other uses.

FUNCTIONAL PSYCHOSES

Unlike the organic conditions, the functional psychoses are not yet linked to any specific pathology of the neural tissues. Their causes are therefore debatable but some hypotheses are worthy of attention. The functional psychoses are usually classified into three groups: the manic-depressive states, the schizophrenias, and the paranoid conditions.

MANIC-DEPRESSIVE PSYCHOSES

The manic-depressive psychosis is the disorder of emotional extremes, either euphoric and excited, or depressed and retarded. Until the end of the nineteenth century these states were described as two separate psychoses, but they have much in common. The first point of similarity is that both mania and depression are variations in the emotional tone and activity level of persons, although the effects are opposite in direction. Second, the intellectual functions are not seriously disturbed in either condition. Third, their course of development is similar, with a high likelihood of recovery

from one attack but considerable danger of recurrence. Also important is the observation that the manic and depressed states often occur in succession in the same person, with or without an intervening interval of normality. A mild manic episode, often so slight as to be disregarded by most observers, not infrequently precedes a major depression. Although recurrence or alternation is common it is not inevitable. Many patients have only one attack of one form, recover, and are never psychotic again. Manic-depressive conditions may begin at any time of life from the twenties through middle age. Recovery from a single attack typically occurs in from six to nine months. A case of manic-depressive psychosis has been described (Case 6, p. 208).

A mild *manic psychosis* is one of the happiest conditions in the world, joyous and optimistic. The patient is also accelerated in all activities, moves quickly, and talks fluently. His general good humor is disturbed only if he is thwarted, when he becomes irritable and angry. His attention is flighty, however, and he is likely to leap from one idea to another. The symptoms are exaggerated in acute mania. A patient in this condition moves constantly, shouts, sings, and may be destructive of clothing and furniture. Since he sleeps little, a patient with acute mania may lose weight and be susceptible to infections. He may be confused and disoriented temporarily but shows no real intellectual deficit. Delusions of grandeur or persecution of a fleeting sort sometimes occur but they are not common.

The *depressive psychosis* is the opposite of the manic condition in all essentials. The patient is grief-stricken, anxious, and depressed. Retardation of speech and movement is almost universal. He talks in a low, plaintive voice and very slowly. Most depressed patients are oriented and understand that something is wrong with them. A few have delusions of sin and unworthiness, or of incurable disease, but the majority are not deluded. The greatest danger in depression is suicide. Many patients are admitted to hospitals after having threatened or attempted to kill themselves, and it may be suspected that a large number of actual suicides are committed while the person is in a state of psychotic depression.

Involucional depressive reaction is a variety of depressive psychosis often classified apart from

the manic-depressive group. It occurs at the involution period, the time when the reproductive glands of both sexes decrease in activity, with compensatory changes in other endocrine glands and overactivity of the sympathetic nervous system. The symptoms include hypochondriacal overconcern, anxiety, depression, and delusions of sin or of persecution. The patient is more agitated than in simple depression and suicidal attempts are common.

Involucional depression illustrates the interaction of physiological and psychological factors. The glandular changes have some relevance and are the events that precipitate the patient's self-concern. But the psychological factors may be more important. A woman in middle life sees that her children are grown and no longer need her care; a man sees the time ahead when he can no longer pursue his work. These situations are somewhat depressing for all normal persons who pass through them. It is not surprising, therefore, that physiological and adjustive crises should coincide in some instances with enough severity to evoke a psychosis.

SCHIZOPHRENIA

The most prevalent of the psychoses is schizophrenia. It accounts for about one-fourth of first admissions to psychiatric hospitals, a proportion exceeded only by the senile conditions. But about 60 per cent of the resident patients in such hospitals are schizophrenics, because the disorder tends to begin at an early age and in many cases continues as a chronic state through many years of hospitalization. Although some cases of schizophrenia occur at all life periods from childhood to old age, the greatest number have their onset in the decade from twenty to thirty. Schizophrenia is the same as the disorder formerly called "dementia praecox," an older term now rapidly passing from use.

It is not easy to give a clear general description of schizophrenia, and for good reasons. Even in comparison to other behavior disorders, it is not a single entity but a pattern of rather heterogeneous conditions. Bleuler, who originated the term in 1911, wrote of "the group of schizophrenias." Even so, it is generally agreed that the schizophrenias all involve a disorder of thinking, a disharmony among emotions and impulses, and a

disturbance of interpersonal relationships. Hallucinations and delusions are common in the severe cases.

The thinking disorder in schizophrenia is different from the intellectual deficit found in the organic psychoses. The thinking of the brain-damaged person is more likely to be meager, limited, or "concrete"; the schizophrenic's thought is more private, personal, or unshared. An illustration from a widely used research method helps to make the distinction clear. In the "object sorting test" a large number of familiar small objects is spread before an examinee; he is asked to choose some that go together and tell why he chose them. A normal person might, for example, select a large number of items—tableware, small tools, a bicycle bell—because they are "all metal." A typical response of a person with organic brain damage, after a slow and deliberate examination of all of the objects, might be to choose only two forks, and say "forks." He is unable to perceive a broader abstract category and limits his response to safe, simple identities. Schizophrenic responses are much more varied and unpredictable but they have a common feature as two examples will show. One schizophrenic chooses a bicycle bell and a cork and says "it means that you shouldn't drive when drinking." Another selects a box of matches and a toy hatchet, with the explanation, "matches are from trees and the ax reminds me of George Washington, February 22, and the winter when you need heat" (McGaughran & Moran, 1956, 1957). The schizophrenic responses are not simplified and concrete; if anything they are over-abstract. But they are bizarre, eccentric, and not shared with other people. Such distorted thinking provides a fertile ground for delusions.

Many cases of schizophrenia, especially in the earlier stages, show considerable emotion but often inappropriate to the stimulating conditions. They are anxious even when not threatened, may laugh in a shallow way when sadness would be called for, or cry without cause. In a later phase of schizophrenia emotional apathy and poverty of feeling is more common, a response possibly representing a defense against lack of success in dealing with emotional situations. The emotional disharmony of the schizophrenic is consistent with his thinking disorder, but it is not established that one of these, if either, is a cause of the other.

Four classical "types" have been identified within the general concept of schizophrenia. Observation shows that some patients do indeed correspond closely to one or another of the classical types, but many others are intermediate, mixed, or unclassifiable. The types therefore have a limited usefulness.

The *simple* type of schizophrenia shows emotional apathy, thinking disorder, and no other striking symptoms. An adolescent or young adult may become listless and do more and more poorly at school or work until he does not bother to try at all. He sits at home, shuns companions, and shows only a shallow irritability if his family tries to stimulate him. The "simple" classification is not used frequently in hospitals, but many more cases may be cared for at home. Some become vagrants.

The classical *hebephrenic* type is described as showing active agitation, with silliness of attitude and marked incoherence of speech and behavior. An apparently sudden onset of psychotic symptoms is preceded by an insidious period of development. The following paragraph describes a hebephrenic patient.

(Case 18.) Helen W., nineteen years old, finished the ninth grade two years ago after an undistinguished school career, and henceforth remained at home. The first symptoms were noticed about six months ago. She would quarrel with her mother, and then go to stay with a married sister. After a few days she would become angry with the sister and return home again. Gradually her family noticed a foolish trend in her conversation. On several occasions she screamed in the night, saying that a man was under her bed. At other times she acted as though she were being chased by someone, which may be evidence of hallucinations. Finally she took to crying and jabbering constantly, and threatened to kill her father and herself. She was then admitted to a state psychiatric hospital. Examination at the hospital showed that she was completely disoriented. She gave irrelevant answers to questions about school subjects and common information. She has a few scattered delusions of being chased by men and calls the physicians by the names of former acquaintances. She is overactive and very destructive, tearing her clothing and disheveling the furniture in her room. She lies on the floor and

rolls over and over, striking herself lightly with her hand while doing so. Frequently she laughs for minutes, but at other times she screams or cries. She makes foolish grimaces and mannerisms, and it is impossible to carry on a connected conversation with her.

The *catatonic* schizophrenic reaction has two varieties, catatonic stupor and so-called catatonic "excitement," both of which are distinguished by negativism and stereotypy either of inaction or action. A typical case of catatonic stupor follows; another has been described earlier (Case 3, p. 208).

(Case 19.) Daniel E., a well-educated young man, developed a psychosis at the age of thirty-one. For ten years before this time he had been increasingly "nervous" and "absent-minded." He would start for a visit and then forget his destination. At times he mistook strangers for acquaintances, and often seemed unable to understand what was said to him. A few weeks before admission to the hospital he left his job, became despondent, and showed an almost complete lapse of memory. He had no sense of responsibility but depended entirely on his wife and others to tell him every act he should perform. He bought poison but never actually attempted suicide. He had no delusions, although he once said without any evidence of emotion that his mother-in-law was poisoning him. In the hospital he took no interest in his surroundings, stayed in bed most of the time, did not attend to his personal needs, and had to be aroused for his meals. He varied greatly from day to day, however, and on one occasion talked enough to demonstrate a good memory for past and recent events. Gradually he became worse. He did not speak for several months, but sat bent over in a chair looking at the floor for hours at a time. He showed "waxy flexibility," retaining for a long period any posture in which he was placed. Some time after admission he was given a type of shock treatment, then quite new, which is described in a following section. He grew more lucid, answered questions, said that he felt better, and appeared almost normal at times. His behavior, however, was still apathetic and lacking in interest. Characteristically, he remembered many things that had happened while he was mute and apparently inaccessible.

Catatonic excitement sometimes alternates with

the stuporous form. It is active, but still out of touch with the perceptual world. A catatonic patient will sometimes show an undirected and automatic frenzy, destroying furniture or his own clothing, or attacking a stranger. More frequent are stereotyped activities such as pacing rapidly or performing an elaborate, repeated series of gestures. Since the behavior shown in such persons is automatic and not responsive to the environment, it is not inappropriate to include them in the catatonic group.

The main characteristic of *paranoid schizophrenia*, the fourth classical type, is the existence of more or less stable and systematic delusions. Its typical age of onset is a little older than that of the other types, and it has a lower likelihood of recovery under present methods of treatment. Because paranoid schizophrenia merges into other paranoid states it is described in the next section.

PARANOID PSYCHOSES

The nature of delusions, an important feature of many behavior disorders, may be studied most successfully in connection with the psychoses of which they are the chief symptom. Let us start with an illustration.

(Case 20.) Gregory E. was a college senior when he developed his delusions. He had always been quiet and studious, with adequate but not outstanding ability. In spite of the fact that he was a good athlete, he kept to himself, made few friends, and had a long history of regarding other people's motives with suspicion. He was excelled both in studies and in athletics by his brother who was only a year older and was his classmate in college. There had been lifelong rivalry between the brothers, with Gregory always the loser. Although previously in robust health, Gregory now began to complain of feeling ill. Eventually he developed a belief, unknown to others until later, that his illness was caused by poisoning. He thought that the men of the fraternities, of which he had not become a member, were poisoning his meals. They stood behind him in restaurants, he thought, and made secret signs to the waiters to put poison in his food. To escape his tormentors he fled to a distant city where his queer behavior attracted attention, resulting in his hospitalization. Later, in the hospital, he developed delusions of grandeur. He claimed that he was the greatest athlete of all

time, imprisoned and poisoned because the fraternities would not permit such eminence to a non-fraternity man.

The development of Gregory's delusions aptly illustrates the classical psychological description of the process. First, there is evidence of a long-standing tendency to be suspicious of other people and to blame them for his failures. This is an adjustment mechanism, strongly reinforced because it reduced his anxiety. Thus Gregory has been *learning to be paranoid* over a long period of time. Second, a precipitating factor appears when he feels ill, just generally physically ill and miserable. It could not be ascertained whether this illness was a hypochondriacal neurotic reaction, a phase of a developing schizophrenia, or just a minor intercurrent illness of an ordinary sort. But why should he, the vigorous athlete, feel ill? In keeping with his long-reinforced mechanism of blaming others, the thought of being poisoned occurs to him. Perhaps he rejects the idea at first but it is such an anxiety-reducing explanation that he finally accepts it. Perhaps the acceptance is facilitated by the development of some degree of the thinking disorder found in schizophrenia. He retains enough rationality, however, to ponder on *why* he is being persecuted. This is solved by the thought that great persons are always persecuted. *If* he were the greatest athlete of all time, people naturally would be jealous of him. The idea is pondered for weeks until the "if" becomes accepted as a fact and the ideas of *grandeur* complete the delusional system.

Delusions, therefore, develop because they are adjustments. They permit an individual to reach a personally satisfying understanding of relevant features of his world. The process of attributing one's own repressed hostile impulses to others is *projection* and is basic to delusions of persecution. Delusions of grandeur have elements of *rationalization* when they explain why one is persecuted, and also have more than a trace of *compensation*.

The existence of delusions certainly implies a disorder of thinking, but the degree to which a distortion of the intellectual functions permeates the rest of the person's life varies greatly from one case to another. In some instances the general behavior of a patient shows a schizophrenic degree of dilapidation, and a diagnosis of *paranoid schizophrenia* is applicable. A case already described (Case 5, p. 208) aptly illustrates the withdrawal,

the flatness of feeling, and the hallucinations which typically accompany the delusions of a paranoid schizophrenic. When there is some generality of thinking disorder but little other evidence of schizophrenia, the diagnosis *paranoid state* is often made; perhaps Gregory E. is best placed in this category.

The term *paranoia* has been applied for many years to a disorder characterized by systematized delusions but no other marked evidence of psychosis. Only about one or two per cent of the patients in hospitals are so diagnosed, but it is probable that far greater numbers are never hospitalized, as the following illustration shows. (Case 21.) A middle-aged man with little formal education believed himself divinely inspired to found a new religious denomination. He preached on street corners and gathered a small group of followers. So far, he was regarded as eccentric but no one raised a question of his sanity. Then he had a "divine revelation" that he was destined to marry the sixteen-year-old daughter of a neighbor and became insistent that the marriage take place. The girl's family objected vigorously of course and, in the end, the man was placed in a hospital with a diagnosis of paranoia. There he bore his "persecution" with humility, and continued to preach eloquently on all possible occasions with no sign of intellectual impairment. As long as his eccentric beliefs were limited to religion—a realm in which our society rightly asserts wide freedom—he was not a "patient"; when he strayed into the field of family and sex he became one. Usually unhospitalized are inventive paranoiacs who believe that they have made great discoveries and litigious paranoiacs who engage in endless lawsuits. Most authorities believe that paranoia is entirely a psychological condition which develops gradually through strongly reinforced processes of learning.

TREATMENTS OF THE FUNCTIONAL PSYCHOSES

Until recent years, the methods used in hospitals for psychotic patients were better described as "care" rather than "treatment." Patients were given rest, sedatives to reduce hyperactivity, warm and cold baths for calming and for stimulation, and occupational and social activities to encourage

attention to reality. In spite of the superficial nature of this program, many patients recovered, a testimony to the self-restorative properties of the human organism. Within the past two decades, however, new methods of treatment have revolutionized hospital practice, have speeded the discharge of many patients, and have permitted some patients who formerly would have been hospitalized to be treated in the community.

PHARMACOLOGICAL THERAPY

Beginning in 1952, several synthetic drugs have been developed that are popularly known as "tranquilizers." One of the most widely used of these, *chlorpromazine*, has a calming effect on almost all agitated conditions. Schizophrenic patients are most benefited when treated at an early stage, when their hallucinations and delusions may begin to disappear after a few weeks of treatment. Their thinking disorder decreases considerably, they communicate better, and many are able to leave the hospital to make a social readjustment within six months. Chronic patients benefit less, even from prolonged treatment, but they are less anguished in the hospital and at least a few complete social recoveries occur. Chlorpromazine also has some value in manic conditions and is used to calm agitation even in senile, alcoholic, and parietic patients. Another drug *meprobamate* is widely used in office practice to reduce anxiety and tension in psychoneurotic and somatization conditions. There are specific antidepressant drugs for depressed patients and anticonvulsants for epilepsy. Research on pharmacological agents is active, and new drugs and applications will almost surely emerge.

SHOCK THERAPY

Insulin shock therapy was introduced as early as 1933. In this treatment, doses of insulin are given which reduce the level of blood sugar so greatly that unconsciousness ensues, with physiological shock evidenced by profuse perspiration, tremors, and spasms. The shock period is terminated by the administration of sugar. Treatments may be continued five days a week for an accumulated total of thirty to fifty hours of shock. A somewhat newer and milder method gives electric shock passed through the brain from electrodes on the forehead. A brief application of the electric current causes unconsciousness and a convulsive re-

sponse similar to an epileptic seizure. Twenty to thirty treatments may be given at a rate of about three a week.

The effects of electric convulsive therapy are highly beneficial for the depressed states of manic-depressive psychosis and for the involutional depressive conditions. As many as 80 per cent substantially recover from their depressions after a few treatments. Some schizophrenics also seem to benefit from electric shock therapy but it is not used for them now as often as before the discovery of chlorpromazine. The rather dangerous insulin shock treatment is now limited to the treatment of schizophrenic patients who have not benefited from the newer drugs, and does produce some recoveries. There is no general agreement as to how shock therapies work. Speculative theories have suggested that they affect brain metabolism, or that they cause selective tissue damage as do the surgical methods described next.

SURGICAL METHODS

A very radical treatment of psychoses by brain surgery was used widely in the 1940's and 1950's but is now largely discarded. One common method involved the insertion of a thin instrument in each side of the frontal lobe of the brain. The instrument was then moved so that it severed the connections of areas of the cerebral cortex with the thalamus. For about a week after the operation, the patient was confused and disoriented. On further recovery some patients were freed of anxiety and bizarre behavior but were by no means normal. They were described as superficial and tactless with quick but shallow emotional responses. Other patients reverted to their former psychotic condition with little or no improvement. In theory, the operation was presumed to reduce tension by removing the connections between the frontal cortex and the emotional centers of the thalamic area.

PSYCHOLOGICAL TREATMENT

Psychotherapy, which is discussed at greater length elsewhere in this book, has been regarded as a valuable method for helping normal and psychoneurotic persons solve their adjustment problems. Intensive individual psychotherapy has been attempted less often with psychotic persons, who have been handicapped by their inability to communicate and their difficulty in forming a

warm relationship with a therapist. The situation has changed considerably with the advent of shock therapy and with the even greater effectiveness of the tranquilizing drugs. The newer treatments have made many patients accessible to psychotherapy, but most hospitals do not have large enough professional staffs to permit intensive individual attention. One constructive resource is the movement to organize the hospital as a total therapeutic environment. Many formerly locked doors are now open. Patients are given more responsibility and are expected to take some degree of initiative in thinking of their own affairs. Staff members, even to the most junior ones, take every opportunity to increase the patient's self-respect and to help him relate to other people. Such a social environment promotes the final steps toward recovery. There is evidence that the combination of the new drugs with a total psychological and social effort is more beneficial than the use of the drugs alone.

INTERPRETATIONS OF THE FUNCTIONAL PSYCHOSES

The causes of the functional psychoses are unknown, in the sense that no one can state with certainty the necessary and sufficient conditions that make them appear. We are not entirely ignorant, however, of some significant correlates of the psychoses and of some hypotheses likely to lead to fruitful investigations.

CONSTITUTIONAL HYPOTHESES

For centuries, many authorities have held that the functional psychoses are basically due to a constitutional defect, transmitted by the mechanisms of heredity. The constitutional hypothesis had its fewest supporters early in the present century when brilliant new psychological theories were being formulated that seemed powerful enough to explain all psychotic behavior in terms of experience and learning. But newer evidence in support of a hypothesis of heredity demands serious consideration, whether we like it or not.

Kallmann (1953) investigated the occurrence of functional psychoses in hundreds of families, at first in Germany and later in New York State. The evidence for a hereditary factor is strongest in the manic-depressive psychoses. In the population as a whole, the likelihood of a person develop-

ing a manic-depressive state is four-tenths of one per cent. But among persons who have a half-sibling with the psychosis the incidence is 16.7 per cent; with a full sibling, 23.0 per cent. Most striking are the data on twins. For like-sexed two-egg (fraternal) twins, the concordance is 26.3 per cent, not significantly greater than for brothers, but for one-egg (identical) twins it is 95.7 per cent.

Similar data for schizophrenia show almost as high a correspondence. The summarized concordances for degrees of relationship are: for randomly paired persons 0.9 per cent, for half-siblings 7.1 per cent, full siblings 14.2 per cent, two-egg twins 14.5 per cent, and one-egg twins 86.2 per cent (Kallmann, 1953, Fig. 36, p. 124). The data on twins correspond exactly to the theoretical expectation for a trait highly determined by heredity. The two-egg twins are no more related genetically than are ordinary brothers and sisters, while the one-egg twins develop from the division of a single fertilized ovum and therefore have identical genes in their chromosomes. These data seem convincing, but the converse also needs emphasis. Except for the identical twins, the percentages are not high. Many schizophrenic patients have no known relative who has had the psychosis.

BIOPHYSICAL HYPOTHESES

Another plausible hypothesis is that there are differences between psychotic and normal persons in chemical and physical properties such as endocrine secretions, the composition of the blood and of other body fluids, the nutrition of the cells of the nervous system, or the electrical phenomena of the brain. All of these phenomena and many similar ones have been explored repeatedly with one disappointing outcome—the more competently the research has been conducted, the more negative are its conclusions. Faultily designed research has, from time to time, come out with widely publicized "discoveries" that fail to be confirmed and fade away. One common error of research design is the physiological comparison of long-hospitalized, agitated psychotic patients with calm, well-fed normal persons. Biological differences found between such groups are likely to be the indirect result of the psychosis (emotional arousal, poor nutrition, unhygienic life) rather than its cause (Arieti, 1959, p. 490).

There remains, of course, the possibility and hope that a subtle component of the physiological

chemistry of the body—as completely unsuspected today as vitamins were before about 1912—may yet be discovered, whose presence or absence determines psychosis. At present, no evidence supports such a proposition.

PSYCHOLOGICAL HYPOTHESES

One valuable psychological hypothesis may be regarded as firmly established. The behavioral features of all psychoses, including hallucinations, delusions, and much of withdrawing or hyperactivity, are adjustment mechanisms. As repeatedly emphasized throughout these three chapters, the mechanisms arise from conflicts and are reinforced and perpetuated because they reduce anxiety and serve other needs. The process is essentially similar in organic and functional psychoses, in psychoneuroses, and in the personal difficulties of normal persons. The symptoms are exaggerated in some psychoses because of the underlying intellectual deficit of the organic states and the thinking disorder of schizophrenia.

Other psychological hypotheses have attempted to account for the more basic phenomena of psychoses. One theory of the origin of the schizophrenic's difficulties in forming relationships with other people, and in communicating with them, hypothesizes a "schizophrenogenic" mother who transmits anxiety and tension in place of comfort to her child at a very early age, yet demands that he remain dependent on her. The child responds by learning to trust no person, and by turning his thinking inward to his own needs instead of outward toward people, in a way consistent with the egocentric thought disturbance found in schizophrenia. Research studies of the mothers of schizophrenic patients have seemed to confirm the theory's prediction that they are relatively distant, cold, anxious, and rejecting while at the same time overprotective. Unfortunately, these studies can only be made of the mothers of persons already diagnosed as schizophrenic, and the mother's attitudes may have been colored by the trying experience of dealing with a psychotic offspring. As an unidentified wit put it, "Psychotic children may drive their mothers crazy." In spite of such criticisms, the hypothesis of the effects of a parent-child relationship has much to commend it and will evoke further investigations.

Another theoretical formulation attempts to account for the thinking disorder of schizophrenia

by drawing on experimental studies of learning (Mednick, 1958). First, the incipient or acute schizophrenic is seen as an extremely anxious person. Laboratory studies show that under a condition of anxiety or high drive, complex verbal learning (thinking) is hampered by an increment in generalization, that is, by thinking of many irrelevant "wrong" associations as well as of the "right" one. If the "right" thought, furthermore, is anxiety-arousing in itself, the "wrong," remote, far-fetched thoughts will be reinforced because they permit the person to escape the punishing consequences of making logical but painful associations. By this pattern, a schizophrenic may learn to make inappropriate but anxiety-reducing responses in many situations. When he has a dim realization of his irrelevant thoughts he does not say "I am going crazy" which would be too painful to accept but instead says, "The radio is putting thoughts into my head." This hypothesis would account for the thought disturbance as itself an adjustment mechanism, instead of a separate defect that underlies the appearance of other mechanisms.

AN INTEGRATION OF HYPOTHESES

The constitutional and psychological hypotheses seem quite convincing when presented separately, and biophysical explanations remain at least remotely possible ones. Confronted with all the evidence, do we have to choose only one theory as true and discard the others? An alternative is that all theories may be correct, but that each applies to a particular group of conditions. As noted before, schizophrenia is by no means a single homogeneous disease but a group of disorders. Perhaps some cases of schizophrenia are primarily constitutional, some are developmental distortions of a psychological sort, and still others are caused by yet unknown biochemical agents.

A more complex and attractive proposition might be that the three factors operate in all instances, in varying proportions and in complex interactions. Schizophrenia (S) may then perhaps be expressed as a function of constitutional (C), biophysical (B), and psychological (P) components, each weighted (k) to an extent appropriate to the particular case. Expressed in symbols,

$$S = f(k_1C + k_2B + k_3P).$$

The untangling of the causes of the psychoses, including the determination of the values of k for

various conditions, is likely to remain for some years to come a challenging field for medical and psychological research.

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PART IV: Professional Fields

CHAPTER 15

Clinical Psychology

Psychology has been applied in many areas to the solution of human problems. In the behavior complex which constitutes the interaction of the individual and his environment, optimum or even minimum passable adjustment is often not achieved. Things go awry; either the individual is unhappy, frustrated, at odds with his family, friends, other associates, and society in general, or some of these other individuals find reason to object to his behavior although he personally may be quite satisfied. It is to the consideration of the application of psychology to the problems of individual adjustment that this chapter is devoted.

In dealing with these problems of adjustment we refer to the workers concerned with them as clinical psychologists. A clinical psychologist is a practitioner since he renders service in connection with these problems. Often he also conducts research on these and other problems that interest him. Ideally he is *both* a practitioner and scientist. Emphasis on practice in the account to follow should not let us lose sight of this other essential task of clinical psychology.

The focus of attention of the clinician has traditionally been upon the individual showing need of psychological services. The clinician has always been concerned with the individual for the sake of the individual; to understand him and to help him, either alone or in collaboration with others. More recently we find that while the clinician is still focused mainly on the individual he may work toward helping the individual through his contact with others who have the face-to-face relationship with the person in need of help. This broadening scope may cause him to function in direct contact or as a consultant in the clinic, the school, or the institution.

CLINICAL PROBLEMS

DIAGNOSIS

In the records of the various clinics and agencies with which clinical psychologists are connected may be found cases of many sorts: The child whose ability is so inadequate that he is called

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mentally retarded, the adult whose behavior is so "queer" that he has been placed in a mental hospital, the adolescent whose inability to decide upon a career results in his request for consultation, the delinquent boy whose antisocial behavior has resulted in his court appearance, the veteran whose war experiences have left him uncertain and afraid, the boy in school who cannot learn to read, the college student who suffers from feelings that he is inferior to his fellows, and so on. It is evident that most of these problems result from some sort of inadequate adaptation; that is, the persons have some difficulty in behaving in ways that are acceptable, either to themselves or to society. The primary aim of clinical psychology is to help each individual client to modify his behavior so that it becomes more personally satisfying or more socially acceptable. In order to do this it is first of all necessary to understand in specific detail the nature of the behavior difficulty and to discover the important etiological (causative) factors which have resulted in this behavior. The investigation of an individual's problem behavior, including an unbiased description of the behavior, significant facts in the person's experiential history, his physical and mental condition, and other pertinent facts, constitutes the field of psychological diagnosis.

TREATMENT

If the ultimate aim of clinical psychology—helping the individual to readjust—is to be successful, someone, psychologist or not, as the case may be, must go further than diagnosis alone, for otherwise the process is sterile. Treatment must be planned and carried out. The mentally retarded child may need care and training, the patient in the mental hospital may need a long series of psychotherapeutic sessions, the adolescent without vocational plans may need vocational information specific to his diagnostically determined pattern of abilities and interests, the delinquent boy may need vocational training and removal to an environment where more socially acceptable behavior may be developed, the nonreader may need specific tutoring in this field, and the college student suffering from an inferiority feeling may need to be taught self-confidence.

MEDICAL, SOCIAL, AND EDUCATIONAL ASPECTS

The precise program to be tried out depends upon understanding not only the individual's be-

havior and the circumstances of its development, but also the nature of the resources, professional and environmental, that are potentially available. In dealing with such problems as these in both diagnosis and treatment, the psychologist cannot be all things to all men; he must depend upon the cooperation of other professional personnel. The retarded child requires a thorough examination by the physician to determine whether medical treatment would be helpful; the mental-hospital patient may require intensive therapeutic sessions with the psychiatrist; the vocationally indecisive adolescent may require the services of the vocational-information specialist; the delinquent may require the social worker's expert help in appropriate placement in a foster home far removed from the scene of his antisocial behavior; the nonreader may require help from a specially trained teacher; the college student with gnawing fears of his own worth may need to be guided by a recreational expert or dean of men into activities that allow his social grace and confidence to develop. General medical practitioner, psychiatrist, vocational specialist, social worker, counselor, remedial educator, and recreational expert are by no means the only specialists with whom the psychologist shares professional responsibility. The probation officer, the occupational therapist, the speech specialist, and the pediatrician are other specialists whose work touches upon that of the clinical psychologist. Thus we see that clinical psychology has very definite relations to many fields, especially education, social work, and medicine.

The clinical psychologist occasionally finds or makes for himself a situation in which he conducts activities perhaps indistinguishable from those in which the other experts mentioned above have at least some vested claim. He may conduct intensive therapy, do remedial teaching, or perform practically any of the duties heretofore used as illustrative of the work of other specialists. This is a defensible procedure when he is properly trained for the work. Then, too, the very nature of the task before him, applying scientific knowledge to practical human affairs, makes it necessary to integrate material from several sciences. While the clinical psychologist is trained to take, and should maintain, an objective psychological point of view, it is necessary for him to use material from other fields—for example, sociology, education, or the medical sciences—to help in

solving the problems he meets. In this chapter we shall be more concerned with the psychological contributions to the study of behavior problems, but we must not lose sight of necessary cooperation among different professional groups.

METHODS

DIAGNOSTIC METHODS

The aim of psychological diagnostic methods is an understanding of the patient's present behavioral status, by an adequate sampling of his past history and present performance in order to reach a diagnostic formulation, which in turn is both a basis for prognosis or estimate of the most probable future course, and a means whereby appropriate treatment procedures may be selected. In order to realize these aims information must be secured in the following four major areas:

- (1) Present behavioral description.
- (2) Physical and psychobiological history and status.
- (3) Psychosocial history and status.
- (4) Behavioral samplings.

The amount of information or the degree of its completeness required in each of these areas will vary from case to case depending upon its nature. For example, mental retardation may be diagnosed with some degree of assurance on the basis of behavioral samplings in the form of psychometric tests, but verification through physical and social history is desirable. The purpose of the diagnosis also influences completeness and relative emphasis, as well as the psychologist's share in the task. Examination for the purpose of considering whether or not a child should be given special tutoring in reading will require a different emphasis from that wherein a severe personality disorder is so psychically crippling that a person is unable to work. Nevertheless, there is enough essential similarity to permit general discussion.

(1) *Present Behavioral Description.* The obvious starting point in the diagnostic phase of a psychological case study is the complaint. Why did the individual come to the agency, clinic, or institution, or why was he referred to it by parent, teacher, social worker, court official, or someone else? The reason given in the referral may be the fact that he is not doing well in his first-grade

school work; the presence of fears that the Masons are trying to murder him; the dislike of the liberal arts course being pursued; the robbery of the neighborhood candy store; the inability to hold a job because of nervousness; truancy from school; or an attempt to commit suicide. In such instances as these there is a curious mixture of causes and effects, relevancies and irrelevancies, facts and inferences. Very frequently the reason given for the referral may not adequately represent the real problem. Thus "not doing well in school" may be described in many ways. The child may be two or three years over age for his grade; he may be receiving average grades, but the teacher complains of his lack of application; the parents may have set standards of A or B grades and are dissatisfied with the boy because of the C's on his report card. In order to facilitate the systematic observation of behavior, check lists and rating scales may be employed. These devices contain a wide variety of behavioral items chosen to be appropriate for the setting in which the problem occurs.

Careful separation of fact and interpretation must always be kept in mind. Inability to hold a job is fact; that nervousness is the cause is an inference. This process of inference, from observable phenomena to hypothetical causes, is perhaps the most complex function of the clinician. It has long been a source of concern and is currently the focus of research and theory (Sarbin, Taft, & Bailey, 1960; Levy, 1963).

(2) *Physical and Psychobiological History and Status.* Psychological behavior is the behavior of a biological organism. Therefore, the physical condition of the organism is always a possible reason for behavior difficulty. In every diagnostic study it is necessary to take the physical conditions into account. Of course the medical examination which is necessary to determine physical condition is exclusively the task of the physician. Although the psychologist need not be a physician himself, he should be sufficiently acquainted with medical matters to integrate intelligently the physician's findings into the total case history.

Certain items of behavior involve physical maturation as well as training and experience. Thus the development of such activities as walking, talking, control of elimination, and so on, depend upon both psychological and biological factors. Since there is relative uniformity of development

in different children, certain normative ages are established at which these acts appear. Thus ascertaining the ages at which they occur offers clues to help in interpreting the individual's behavior. If the majority of the behavior patterns occur at a late age, one is immediately suspicious of a general behavioral retardation, indicating mental deficiency or borderline ability. Inconsistency in developmental sequence may reflect parental attitudes or abilities. For example, late establishment of elimination control may mean that the mother made no effort to train the child because of her fear of tiring him, or because of ignorance or lack of interest in establishing such control.

Certain forms of physical illness are of considerable importance in properly interpreting the behavior of the individual. One of these areas is general vitality, that is, the adequacy of general physical status. Malnutrition, tuberculosis, and cardiac conditions are relevant here because they reduce the subject's activity and effort. In turn, his achievement and the adjustments dependent upon it are decreased. Crippling conditions—whether due to neural, muscular, or bone and joint pathologies—disturb the normality of action and in this way directly affect the patient's behavior and attitudes. Neurological pathologies are traditionally thought to be uniquely related to behavior pathologies. Endocrine disorders are also important to behavior. The cretin, with his extreme hypothyroidism, is usually severely retarded. On the other hand, the hyperthyroid individual is more active and more irritable than the normal. Sensory defects, especially in vision and hearing, are important causes of poor school adjustment in children, and of occupational difficulties in adults. In fact, any physical factor may assume special psychological significance if the individual's reaction to it is in some way exaggerated.

(3) *Psychosocial History and Status*. The patterns of behavior, the attitude, the outlook on life of every individual are specifically determined by the interactions of that individual with his environmental conditions. This is, therefore, another large area that we must know about before we can understand the person's behavior. Every individual interacts with a variety of social groups and inanimate physical conditions. In infancy and early childhood the family is the most important of such groups; with increasing age the neighborhood, school, gangs, occupational, and recreation

groups, and so on, become increasingly important. Depending upon the age of the client and the nature of his problem, information in some or all of these directions is necessary.

For children, the family is the fundamental social group. At the time he is being studied, each child (excluding for the moment children in institutions) is a member of a family. There is an increasing amount of evidence indicative of the relationships between problem behavior in children on one hand and the behavior, attitudes, and child rearing practices of parents on the other. The child is profoundly affected by what goes on in the family; we are just beginning to understand the specific sources of influence and the mechanisms whereby they operate.

The economic condition of the family and the physical nature of the client's home may be indicative. The stealing of a boy who comes from a poverty-stricken home is a very different problem, even a different kind of behavior, from that of the spoiled son of wealth. Economic inadequacy means a greater worry and strain which colors all the family relations. On the other hand, economic plenty may mean an overabundance which stifles independence and resourcefulness.

But the child is not solely a product of the family constellation. He has friends, attends school, is influenced by other social institutions. How the child feels about his peers and his teachers, and how they feel about him are all important questions which must be taken into consideration. The adult must also interact with friends, coworkers, employers, and other authority figures representing aspects of social living.

While different schools of psychological thought attribute greater or lesser weight to the influence of the past on present behavior none completely negates the usefulness of information concerning the person's past experiences.

A few paragraphs above we called attention to the importance of the conditions in the child's home. While the home situation at the time of examination is important, the cumulative effect of past conditions may be of even greater significance. For example, the way the child was treated in infancy may be reflected in his present feeling of security or insecurity. Serious changes in the dynamics of the family—a new sibling, death of a father or mother, divorce, or the introduction of a stepparent—may have had a serious influence

on the subject's attitudes and behavior. Emotion-provoking situations, such as a frightening experience or the constant thwarting of desires giving rise to anger, may now be forgotten, but their influence remains evident in behavior patterns.

In the direction of academic or vocational achievement, the effects of formal educational experiences are important. It is necessary to know about the individual's school history—including not only formal achievement records but also his success in adjusting to the teachers and other children. For adolescents and adults an account of vocational experiences will be significant. In short, no item of the subject's life experience is entirely foreign to our needs.

With the vast amount of experiential material which could be recalled, there is a need for research and theory to suggest where to look in terms of the kinds of experiences which may lead to psychological maladjustment. There are also available to the clinician instruments which help standardize the history taking (Briggs, 1959) and which yield, in some situations, quantitative results which can be used for predictive purposes (Phillips, 1953). Nevertheless the clinician most frequently goes where his client leads him; what is trivial for one person may be traumatic for another. As we have said before, the person is a biological organism and organisms differ in their resistance to stress.

Aside from the physical examination, the collection of most of the material heretofore considered is conducted by means of the interview—a conversation with a purpose, as someone defined it. Varying from almost casual conversation to a much more systematic series of questions and answers according to the phases of the case study in question and to the nature of the clinician-client relationship, the interview is the basic technique used. However, these areas of inquiry are open both to verification of many of the inferences drawn from the interview data and to the elucidation of new material by means of behavior samplings in the form of psychological tests.

(4) *Behavior Samplings.* A psychological test has been defined as a means of sampling an individual's behavior in a standard situation (Hunt, 1946). A patient or client given a psychological test is provided with a means of showing what he does when faced with a certain carefully standardized situation. The individual test as distin-

guished from the group test is most often used in the clinical situation because of the greater richness of personal observation possible when a single examinee is studied by the clinician. Either group or individual tests permit the derivation of a variety of numerical scores, but in this process we should not let the apparent abstraction of these scores blind us to the fact that it was certain ways in which the person behaved that made the scores possible. *How* he did it is often as important as the correctness or incorrectness of the answer. Indeed, some tests, especially those devoted to the study of attitudes, interests, and personality, cannot be said to have right or wrong answers.

It might be best, however, to consider first the tests where the gratification of scores is of relatively greater importance. Intelligence tests fall into this category. All intelligence tests present certain tasks to the subject. He is required to do as many tasks as well as he can. The tasks may require understanding and use of language as in the well-known Stanford-Binet (Terman and Merrill, 1960) test, or they may require manual performance based upon insight into the task as in form boards, picture-completion tests, and mazes. Regardless of the kind of performance required, the subject's success is compared with norms based upon the results from large representative groups of children or adults. The scores on the tests are computed on all-or-none passes and failures, time, errors, or according to a point system for quality of response. They are frequently expressed in terms of a performance age or mental age. This means that if the child has a mental age of seven years, his performance is equivalent to the average performance of seven-year-olds. This mental age in itself is not very meaningful unless we know how old our subject is. For example, a performance age of seven years would mean very different things in a five-year-old and twenty-year-old. In order to express this relation easily, the ratio between the two values, that is,

$$\frac{MA}{CA} \times 100 = IQ$$

has been widely used. It is evident from this formula that the intelligence quotient, IQ, is the percentage of the expected performance that the person actually earns.

The IQ has become a common term in the English language. This is unfortunate because it

implies a significance which the ratio does not actually possess. In the first place IQ's or the performance ages from two or three different tests may be numerically quite different and have quite different meanings. IQ's at different age levels may even mean different things on the same test. Furthermore, the obtained IQ may have been influenced by conditions of the subject or the examiner purely extraneous to the subject's performance ability. Poor health, emotional disturbances, fear of the examiner, carelessness on the part of the examiner, and many other things may operate to lower the score. The IQ's are not foolproof values and are meaningful only when interpreted cautiously in the light of all information available.

If one keeps in mind that IQ's or other expressions of test performance are not absolute measures, they may be extremely valuable. Experience and experiments have shown that there is a significant relationship between performance on a test like the Stanford-Binet and school achievement. Therefore, low test performance may explain poor achievement and give some basis for prediction of future school and even occupational achievement. A comparison of the performances on language and manipulative tests may indicate strengths and weaknesses in ability. In brief, intelligence-test results may eliminate or establish deviate abilities as causative factors in many types of behavior problems.

The use of psychological tests when problems of differential diagnosis arise has been a major area of application. From diagnosis hopefully stem both prediction of the course the individual's behavior will take and information valuable in deciding what measures are appropriate to alleviate or to remove the causes of the condition. Therefore, accuracy in diagnosis is important, not merely to give a label but to work intelligently and capably for the sake of the individual. The apparently clear-cut distinctions among various disorders of adjustment made in textbooks are necessary for the sake of clarity in presentation, but the person who comes to the clinician is likely to show little resemblance to classical descriptive models. Often interview and general observation will not give enough information to differentiate clearly between one sort of disorder and another, since some symptoms point one way, others in a different direction. It is here that differential diagnosis on

the basis of examination by psychological tests is useful and sometimes crucial.

An illustration of one sort of differential diagnosis will make this more clear. Police authorities requested examination of a man about thirty-five years of age who had been arrested for armed robbery. They had noticed some things peculiarly stupid in his behavior, including a lack of planning or elementary precaution in regard to the crime for which he was apprehended. A search of community social service records showed both that he had spent some years in a home for the mentally retarded and that the results of intelligence testing gave him an IQ in the neighborhood of 60. Mental deficiency, the previous diagnosis, was naturally suspected and a routine check made. The Wechsler Adult Intelligence Scale (Wechsler, 1958) widely used for testing adolescents and adults was the means whereby suspicion was first aroused that something was amiss in the previous diagnosis and treatment.

A momentary digression is necessary to explain this device briefly. It permits ready comparison of each of the 11 subtest scores with all the others individually, since in the process of standardization each was equated with the others. Subtests such as those measuring digit-span, arithmetic problem solving, assembling objects, arranging pictures in sequence, and vocabulary knowledge are relatively independent measures, each yielding a score capable of direct comparison with the scores for the other subtests. Each of these subtests taps to some degree a different mental function or functions. Thus each subtest has a meaning or rationale. Since we know that individuals with different mental disorders often show characteristic patterns of mental functioning, it is not surprising that there can be more or less representative patterns in the test scores—that is, high in one test, low in another, almost always failing before reaching a certain level, and so on—because this behavior is frequently observed in certain disorders.

To return to the patient in question, scores on vocabulary knowledge, general information, and arranging blocks in designs were actually above the average of individuals of normal intellectual attainment. In tests which measure ability to concentrate, practical judgment, and certain other functions, he was so very low that his total score when the subtest scores were added placed him

numerically as mentally deficient. Nevertheless, his behavior as demonstrated on the tests in which he excelled was of such a quality that a mentally deficient person would be utterly incapable of performing in this fashion. He did certain things a mentally retarded person cannot do and thus threw strong doubt on the diagnosis previously made. Verification on the basis of other findings confirmed the diagnostic inference of schizophrenia, one of the major psychoses. Since his average level of functioning was so low, he had for years been considered mentally retarded and had been treated as such, so that instead of receiving appropriate diagnosis and consequent appropriate treatment which might have restored him to normal adjustment, he was mishandled, with the hardly surprising result that he had not recovered; indeed he had probably grown worse.

In addition to the several types of so-called intelligence tests a large number and variety of other measuring instruments have been devised. A very important class is achievement tests. These amount to standardized examinations in particular subject matters of the school curriculum. They are available for almost all subjects of the elementary grades, high school, and college. Their value for the psychoclinician lies in the opportunity offered to measure school achievement, uncomplicated by the question of the teacher's bias or local standards.

Aptitude tests, by sampling performance in areas significant to a certain kind of task—for example, mechanical, musical, artistic, or clerical—give some indication of a subject's possible success in those fields. In nature they are similar to both intelligence and achievement tests and may be used in the clinic to secure information on abilities in specialized fields, especially for the prediction of future performance.

Interest tests, which can assess the degree to which an individual's interests in various areas of endeavor approximate those of the general population or those who are known to be successful in certain occupations, are also valuable in the prediction of occupational success.

There has also been much interest in the development, validation, and clinical use of the personality questionnaire. While the test development rationale varies from test to test most of the instruments have in common that fact that they ask for

a verbal report from the subject about his behavior in situations which are presented in the test items. Response alternatives are most frequently "true" or "false," although some tests require the subject to estimate the degree to which he endorses or rejects an item. A vast literature has accumulated relative to these tests with well over 600 articles having appeared on the Minnesota Multiphasic Personality Inventory alone (Welsh & Dahlstrom, 1960). Recently there has been a trend toward the use of these tests in a so-called actuarial manner; scores are handled mathematically via regression equations to yield specific predictions about the current state of the personality as well as future behavior. Proponents of this approach to personality assessment feel that not only are the tests more valid (accurate) when used without being contaminated by subjective interpretation by the clinician but that the clinical psychologist can thus save time which can be better put to use in therapeutic endeavor (Meehl, 1954).

Projective devices form an especially important class of measures of personality characteristics. They differ from the tests previously described in that the subject is allowed practically unlimited scope in his responses. The essential feature of all the varied means of measurement in this field is that the individual child or adult, with little or no instruction in what to do is presented with a stimulus, but semi-structured in character, and requested to tell what it is or to do something with it. The media whereby this is done include pictures, ink blots, toys, clay, painting materials, words, and incomplete sentences. Ambiguous, with vague or contradictory meanings, as these media are, the subject gives them whatever meaningful connotation his personality permits; the response is thought to be determined more by the dynamics of the personality than the nature of the stimulus.

The Rorschach Psychodiagnostic Test has probably been the most widely used device for personality appraisal, especially for the qualitative aspects of intellectual functioning, and the dynamics of the affective or feeling life of the individual. It consists of a standard series of ink blots, some colored, others of shades of gray. The first card is given to the subject with little more instruction than to tell what it seems to be, what it means for him. He does with it and talks about it as he sees fit. What the situation becomes is dependent on the

subject. The blots themselves have no clear-cut structure, and each one is capable of widely variable interpretation even by the same subject. At one second he may "see" an elephant, at the next second the large colon. The time taken, the method of handling the cards, and the responses given are recorded by the clinician, who later scores according to a variety of categories and ratios of one type of response to another.

It will be remembered that the Rorschach is known as a projective device because whatever meaning is given the blot is projected, that is, placed into it by the subject. For example, an individual may see "two girls dancing" and go on to describe the grace of movement, the swirling of their costumes, and so on. A moment's reflection will show that there was actually no movement, let alone two girls "in" the ink blot. Something about the blot suggested this to him, while to another person it suggested merely a group of clouds.

Since the individual is not hemmed in with specific instructions, he is more or less free to respond as he pleases. What he pleases to do, however, in the hands of clinically acute individuals is capable of surprisingly detailed interpretation. To those unacquainted with the rationale of the test the amount and apparent depth of interpretation that are given seem to smack of something magical. This lack of objectivity is displeasing to some psychologists since ordinary methods of scientific verification are difficult to apply. The suspicion with which they view projective measures is heightened by the claim of some protagonists of these measures that the customary methods of validity measurement do not apply.

Despite the fact that the majority of formal validity studies of the various methods of interpretation have been disappointing, individual clinicians, having developed their own "norms" through many years of experience find the tests useful and meaningful. A recent development in the field has been the publication of the Holtzman Inkblot Technique (Holtzman, Thorpe, Swartz & Herron, 1961) which is modeled along Rorschach lines. The development of this test, however, has been guided by more scientifically acceptable psychometric principles. The types of tests mentioned above by no means exhaust the tools of psychometric investigation. Frequently in clinical work instruments are used to measure other aspects of

personality and emotional stability, as well as motor coordination, sensory acuity, social maturity, economic status, and so on.

METHODS OF TREATMENT

Although the methods of diagnosis used by the psychoclinician are basically the same in many instances, this is not entirely the case. Some methods of treatment have a special diagnostic procedure incorporated directly into their treatment procedures, or indeed hardly have a formal phase deserving the name of diagnosis. In addition, even if such exceptions as those just mentioned are disregarded, it is impossible to speak of a treatment method since, although diagnostic procedure may be similar, methods of treatment vary widely. Therefore, it is not possible to set forth therapeutic plans that can be easily adapted to the requirements of each new case. All methods do have in common the production of a state of affairs in which adjustment to the environment is such that the individual can satisfy his needs. It is possible without doing too much violence to the facts to describe three major types of treatment, although each is apt to be a matter of emphasis of one approach rather than the complete exclusion of the others.

Psychotherapy. Psychotherapeutic procedures are frequently said to fall into two general types—supportive therapy and insight (uncovering) therapy. The first is concerned with giving the individual enough help to stand life's vicissitudes without, however, effecting permanent personality changes. An individual who has a problem, who has an emotional upset due to some environmental disturbance, is helped along by suggestion, persuasion, information, orders on what to do, and so on. Once over the difficulty, the individual is essentially the same person as before.

Symptomatic treatment, that is, removal of symptoms without getting at the underlying causes, belongs in this category. For example, hysterical blindness may be removed by hypnotic suggestions to the effect that the individual is no longer blind, but the psychodynamic constellation which created the symptom in the first place is still present and the blindness may appear again or the unchanged personality pattern may result in the appearance of other symptoms, such as a loss of feeling in an arm. The person is not changed, the symptom is removed, and it is widely held

that what made it appear in the first place may make it come back or appear in different guise.

There is, however, a school of thought, which in many cases tends to equate the symptom and the disease. A basic notion here is that the symptom is acquired through the process of learning and can be removed by the application of learning principles as well. When the symptom is removed, its "cause" is also removed and reoccurrence is neither automatic nor even likely. While this approach to psychotherapy has a long history it is perhaps most clearly exemplified today in the writings of Wolpe (1958) and Eysenck (1960).

Much of what is called guidance or counseling is supportive in nature. The person who is in doubt about his vocation, after the diagnostic procedure previously described, may merely need reassurance that his plans are appropriate or he may need information about certain vocations in order to reach a decision. In many instances no more is needed; the individual's personality is strong enough, a temporary treatment need is met, and the individual goes on without further assistance. Judgment, however, as to whether or not something more is necessary is by no means easy. The cause of his appearance in the clinic—inability to decide on a vocation—may or may not reflect adequately the true picture. He may, for example, have an insatiable longing for dependence upon someone, disguised even from himself, which, in turn, may be symptomatic of a deeper and more severe personality conflict. Although the vocational indecision may be cleared up, it will be replaced by other problems. This, however, should not be taken as a general criticism of the value of guidance. In most instances where it is applied, it is useful and appropriate.

Classical psychoanalytical technique, the theoretical basis of which is examined briefly in Chapter 14, is considered to be primarily an insight therapy. The individual in the course of his analytic sessions is led to understand himself by learning to handle more healthfully the same emotional constellations against which he developed defenses of a maladjustive character prior to his analysis. In the permissive, protective atmosphere of the analytic hour he tries out his emotional patterns on the analyst to whom he has formed an attachment (transference). Gradually he is encouraged to use these same ways of dealing with his emotions in actual life situations.

Understanding why he did or thought or felt certain things, because the reasons have been uncovered, he can give them up and adopt the more adjustive, more healthful, more self-understanding ways of dealing with the problems of everyday living. This insight is by no means merely intellectual; it includes a large emotional component, since the individual must feel all the manifold implications of his thought, feelings, and actions, and accept them, not merely understand them rationally.

Another insight therapy, the nondirective or client-centered approach, vigorously fostered by Rogers (1951), a psychologist, has gained considerable vogue among psychologists as a means of treatment. The client, himself, is responsible for the direction the sessions may take—hence, the rather misleading term "nondirective," for what is, more strictly speaking, apparently "nontherapist-directed." "Client-centered" expresses the idea more positively, placing the emphasis on the client's understanding of himself. Both by a permissive attitude and verbal expression, the clinician says, "This is your hour: do with it as you will; talk about what you want." Free expression of feeling is encouraged. The clinician responds primarily to what he judges to be the feeling of the client, being careful not to persuade or advise, and thus he assumes what superficially, at least, appears to be a passive role. Since self-insight is stressed, the clinician does not have to know too much about what is going on; to reflect, to verbalize, feelings as they appear is enough. The individual patient, considered to have a tremendous capacity for self-growth, is supposed to achieve self-understanding and independence, and, at some point along the way, to realize he no longer needs the sessions and then more or less spontaneously to close the meetings. Little attention is paid to diagnostic procedures as we have described them since they are considered unnecessary.

Criticism by other psychologists and by psychiatrists has been quite strong, centering in many instances on what they consider to be a superficial approach by inadequately trained personnel to a very complicated problem. They point out that mere acceptance of feeling is not enough, that there is really active direction even if the counselor does not realize it, and that active direction must be consciously in the hands of the therapist, not left to the self-insight of the client alone,

especially since the cases thus treated may well include some for which a little self-knowledge is a dangerous thing.

It should be pointed out that Rogers, his collaborators, and his students have been responsible for a great deal of empirical research into both the process and outcome of psychotherapy. They were the first to utilize extensive sound recordings of therapy sessions for teaching and research purposes. They have been more willing to subject themselves and their work to research scrutiny than any other group.

Lest the conclusion be drawn that supportive and insight therapy are sharply and distinctly different, certain factors common to all forms of psychotherapy should be mentioned. The patient's confidence in the therapist is necessary for changes to take place. If he doesn't believe in the ability of the clinician, the desired effects are hardly likely to come about. Confidence in the therapist is a reaction to certain limited aspects of a larger, more important factor common to all psychotherapy, the personality of the therapist. Although not all that goes into the making of the personality of a successful practitioner is known, there would be little quarrel with the statement that some of his traits would be self-confidence, permissiveness, calmness, friendliness, ability to handle problems nonjudgmentally, alertness to the feelings of the person, and the like. Certainly no school of psychotherapy can lay claim to the adherence of all good therapists. At the same time, research (Fiedler, 1950) has shown that experienced therapists from different schools tend to create very similar therapeutic atmospheres.

Another common element in psychotherapy is the opportunity for catharsis, roughly equivalent to the common experience of "getting something off one's chest" whether by words or actions. The outpouring of emotionally toned material in itself is beneficial. A form of therapy which stresses this feature of release of emotional tension is play therapy. This is a method of helping children work out their problems through play, which is their natural means of expressing themselves. The child is encouraged to use toys, paint, clay and water in any way that he sees fit, not rigidly regulated as in so much "nice" play. Often the child acts the way adults do when they take it out on the woodpile. A child may throw the clay on the floor and step

on it; he may cut, hit and throw toys, spill water on the floor, and dismember dolls, so constructed as to be readily disjointed, thus obtaining pleasure and relief. For example, a child referred to a psychiatrist because of temper tantrums, periods of not speaking, and lack of responsiveness to affection, was found after nineteen such play sessions to show a definite increase in affectionate responses and a more outgoing outlook along with a marked increase in speech. No interpretation was offered the child, the release engendered seeming to be enough to produce these changes.

It might be thought that since no greater self-understanding was brought about, this could properly be classed as a supportive therapy. However, it is one of the virtues of the play approach that it can be used both as supportive and as insight therapy, with most cases involving emphasis on one or the other rather than a total exclusion.

An instance of insightful play therapy is the interpretation for the child of his play with dolls that he has identified as mother, father, brother and sister, with particular emphasis on the feeling he exhibits toward them. If a six-year-old boy in playing with the boy and girl dolls says that "the boy" is angry at his sister doll, the therapist will not rush interpretation but will agree by reflecting back in so many words the same statement. Only when the boy says, "I am angry at my sister too," is the therapist in a position to interpret the hostility the child feels toward his sister, which he has been in the process of playing out. Thus we see that both release and interpretation take place in the same process; the child obtains relief, builds up trust in the therapist and in the situation, until he can face the fact that he has these feelings toward his sister.

A word of caution should be expressed relative to the effectiveness of psychotherapy. The claim that it is a cure-all for mental and emotional disorders is definitely not supportable nor is such a claim made by responsible therapists. There has, in fact, been real difficulty in demonstrating that therapy, even of a prolonged and intensive nature, is more successful than much less complicated and time consuming approaches—even those of milieu therapy or simple supportive counseling by relatively psychologically naive persons.

Environmental Manipulation. From the expulsion of Adam and Eve from the Garden of Eden

to the present prescription of a month in Miami, environmental manipulation has been a favorite device aiming at changes of human behavior. Often it did not work because it was given blindly on no more grounds than the pious hope that "the change will do you good." The difficulty was not in the method as such, but in its inexpert application. Increasingly acute professional use has demonstrated its value when changes in environment have been related to individual needs. Inasmuch as a person's behavior is determined in large measure by the environmental factors in which he lives, some attack on these if they be maladjustive is indicated. Sometimes, then, geographical change is necessary; witness foster homes, institutions for the mentally retarded and delinquent, prisons, and mental hospitals. Although other methods dealing directly with the patient may be applied at these institutions, some of the treatment value consists of removal from an environment which was conducive to behavior difficulties.

Environmental manipulation is by no means limited to geographical manipulation; often it is more dependent on changes of attitude of those in orbit of the individual. Particularly successful with children are attempts to change parental attitudes and methods of dealing with the child.

A mother of a ten-year-old girl complained first of the child's enuresis and then of her disobedience and forwardness. Investigation of the problem revealed that a five-year-old brother received most of the attention from both parents. Without paying specific attention to either the enuresis or the disobedience, the parents were advised to plan the children's bedtime so that the girl would have a half hour alone with the parents. In two weeks the father voluntarily reported that the girl's whole attitude had changed and that there were definite signs of improvement as regarded the enuresis. In this case nothing was done about the problems as such, but an effort was made to relieve the tension surrounding the girl's feeling of neglect. With correction of the cause the symptoms disappeared.

In such instances it is the parent who must carry out the details of the corrective program. The parents must assume some responsibilities in many cases in which the school or persons outside the school are primary factors. If the parents cannot or will not cooperate, or if one or both are dead, the problem may involve finding a suitable

foster home. In such cases the cooperation of social workers or child-placing agencies must be secured. When the behavior problem or an academic adjustment problem is associated with the school, the corrective program must be in that direction. It may mean reassignment to grade or classroom, irregularity in curriculum, change of school, and so on. Here the teachers and school administration must assume responsibility for carrying out the program under supervision of the psychoclinician.

Another form of environmental manipulation is milieu therapy. This form of treatment is almost always carried out in an institutional setting and involves the structuring of the institutional atmosphere in such a way that it comes to bear most directly and effectively on the patient. In such an approach everyone who comes in contact with the patient is considered a "therapist" and daily activities are arranged and organized with their effect in changing the patient's behavior in mind.

Prevention. As has been true in other areas of human health the best approach to the cure of mental health problems no doubt lies in prevention. In the mental health field prevention has been seen to have two facets. In secondary prevention the focus is on the amelioration of small difficulties before they become major maladjustments. Thus, the school psychologist consults with teachers and administrators on a continuing basis to help with whatever problems of pupil adjustment that may occur. In primary prevention the emphasis is toward the organization of the home and the external environment in ways designed to promote positive mental health and emotional development. Here the focus may be on parent education and classroom atmosphere with the professional person acting in a consultant or resource capacity.

TYPES OF PROBLEMS

Clinical psychology is practiced in all spheres of human behavior in which problems of human adjustment arise. The previous discussions of abnormal psychology in Chapters 12 through 14 and the later discussions of vocational and professional psychology in Chapters 16 through 19 illustrate problems with which the clinical psychologist is concerned. However, here attention will be di-

rected to issues in which the clinical psychologist made his earliest and most distinctive contributions, the problems arising from mental retardation, from the school, and from the behavior problems of children.

MENTAL RETARDATION

In Chapter 9, in connection with differential psychology, the distribution of ability levels is discussed. Those persons whose behavior places them at the lowest end of this distribution are commonly spoken of as mentally retarded. Because of their limitations academically, occupationally, and socially, the retarded are all psychological problems. It is with this group that clinical psychology has made some of its most useful contributions.

Mental-Test Criterion of Retardation. The most recent attempt to standardize terminology and classification (Heber, 1959) suggests that five levels of retardation be delineated on the basis of test performance. These levels are based on standard-deviation units of test scores in the general population and thus the ranges of IQ subsumed by each level will vary according to the particular test. For the 1937 Revised Stanford-Binet they are as follows: Level V (IQ 83-68) Borderline retardation; Level IV (IQ 67-52) Mild retardation; Level III (IQ 51-36) Moderate retardation; Level II (IQ 35-20) Severe retardation; Level I (IQ less than 20) Profound retardation. This classification system notes specifically, however, that fluctuations will occur in measured intelligence from time to time. Thus, other criteria must be considered. In fact, mental retardation is defined as "subaverage general intellectual functioning which originates during the development period and is associated with impairment in one or more of the following: (1) maturation, (2) learning, (3) social adjustment."

Retardation and Adaptation. Because behaviors sampled by intelligence tests are major factors in adaptation the measured level of intelligence will correlate with level of adaptive behavior. There will, however, be discrepancies. Since standards for adaptive behavior obviously vary with age this facet of functioning is evaluated in terms of the degree to which the person meets the standards of personal independence and social responsibility expected of his chronological age group. Adaptive behavior is perhaps best measured at this time by the Vineland Social Maturity Scale. At older ages,

however, the scale must be supplemented by clinical observation and social study.

Level I and II Retardates. Inasmuch as retardation is not defined in terms of measured intelligence alone, the psychologist has a very definite diagnostic task. The diagnostic problem of the two lowest levels of retardation is usually not difficult, and an adequate conclusion can be drawn on the basis of test performance where the IQ is consistently below 35. Comparison of nonstandardized behavior, such as play, will also provide clues. The developmental history will generally show uniform retardation. In short, the lowest levels of mental retardation are not difficult to recognize. These individuals almost always require institutionalization.

Level III Retardates. These individuals present more of a diagnostic problem since their adaptive and social behavior frequently determines whether or not they can be maintained outside of an institution. Those in this level of measured intelligence are frequently referred to in educational circles as "trainable." Given specialized instruction they can frequently acquire sufficient skills in self-help and the avoidance of danger that they may remain at home. Close supervision will always be necessary, however.

Level IV and V Retardates. The highest levels of retardation constitute the majority of all the mentally retarded and many times they are of high enough ability to remain in the community. Individuals at these levels are considered "educable" and many school systems make special provisions for them. It is these highest groups which are the most difficult diagnostic problems. Program planning at these levels must be based to a considerable extent upon adaptability and social adjustment. While performance on a number of tests at different times is a good starting point a final diagnostic formulation and placement decision can only be drawn through a knowledge of other facts. How well has he adapted to previous social requirements? What are the details concerning his school achievement to date? Has he exhibited impulsive or delinquent behavior? These are examples of questions which should be answered.

Two cases will make clear the contrast between the feeble-minded and the not-feeble-minded when both have shown similar test performances. One man of 25 has a mental age of 8.5 years (IQ about 60) on the Binet; he left school at 16, having

reached only the fourth grade, but it is reported that he always seemed eager to learn and worked hard; after leaving school he obtained a job in a garage as a chore boy and in a few years he learned something about auto mechanics; he is now working steadily and is considered a good workman, although a little slow. The second case is that of a girl of 18 with a mental age of 10.5 years (IQ about 75); she left school at the age of 16 when in the sixth grade; her teacher reports that she was promoted because of her size rather than her work; she was always a troublemaker and in conflict with both teacher and parents; at the time she was seen she had been arrested for solicitation; she did not mind going to a penal institution and, yet, stated she intended to "go back on the streets" when released. Brief though these cases are, they do indicate the dangers of accepting test results at face value. The man apparently has a higher ability in manual skill which he is able to use in making a vocational adjustment at a relatively high level. On the other hand, the girl does not use her ability to its best advantage and seems unable to make an adequate social adjustment.

SCHOOL PROBLEMS

As the clientele of many psychological clinics consists predominantly of school-age children, it is evident that school problems would be very frequent. Children are referred to clinics because of generally poor school work and/or retardation, because of disabilities in specific subjects, and because of social and personal adjustment difficulties. The last of these we shall consider later.

Low-Grade Level of Ability. There is no doubt that most children who are retarded in their grade placement are below average in ability as measured by tests. In the smaller proportion of cases their ability may be low enough to be considered mentally retarded. In a much larger proportion of cases, perhaps 15 per cent of all school children, the mental level is higher than mentally retarded but lower than average. The task of the psychologist in these cases is to evaluate the evidences of mental level and advise the teachers what they may expect from such children.

Nonintellectual Factors. While low ability is certainly a reason for academic retardation and poor school work, it is not the only reason. One of the tasks of the school psychologist is to deter-

mine the real reasons for the child's poor work. Apart from low ability, we find that children may be academically retarded because of poor physical condition, inadequate visual or auditory acuity, emotional and personality disturbances, poor work habits, irregular school attendance including absences and changing schools, personal attitudes of discouragement and inadequacy, parental attitudes stimulating the child against school, special difficulties in one subject, and many other less common reasons. The discovery of reasons for poor work will require careful clinical study of the child and his history—it is very definitely a purely psychoclinical problem.

Special Academic Deficiencies. Special disabilities in school subjects are rather frequent academic problems. A child may be doing well in all of his work except one subject, such as reading, history, algebra, or language. Quite evidently such a special deficiency will reduce the general average of his work and in certain cases will be a reason for poor achievement in much of his subsequent study. In the primary grades attention is devoted chiefly to those subjects—reading, writing, spelling, arithmetic, language—which are the necessary tools for all academic work. The work of higher grade levels includes subjects such as history, geography, and science, the content of which is most important. All of these obviously require skills in the tool subjects, and inadequacies in the content subjects are usually based on lack of the tool skills, unsatisfactory preparation, lack of motivation, or social or personality difficulties which interfere with many adjustments.

BEHAVIOR PROBLEMS

Probably the difficulties most frequent in general child-guidance clinics are those commonly called primary behavior problems. These include habitual patterns of behavior, not due directly to physical or mental disabilities, which either are socially disturbing or interfere with the individual's own personal adjustment. The former types are usually called conduct problems, the latter personality problems. This simple dichotomy has its empirical as well as logical foundation (Becker, Peterson, Hellmer, Shoemaker and Quay, 1959; Peterson, 1961) and we shall use it as a convenient way of dividing the problems into groups for discussion.

What Is A Behavior Problem? Although we speak of problem behavior, we must realize in the very beginning that there can be no precise designation of what kind of behavior is a problem. We know by observing a person how he behaves, and we can know his thoughts, beliefs, ideals, attitudes, and other such implicit behavior only by observing what he overtly does in various situations or by observing what he says. This is true of any sort of behavior. If what he does or says violates standards, ideals, or rules of the social group, we immediately consider it problem behavior. Thus the child who swears is frowned upon; the thief is socially condemned; the temper tantrum disrupts the household. All these types of behavior and many more are considered problems because they are socially disturbing. This much is clear.

If we look a bit further, however, we find that the swearing child's parents do not object; the policeman is not concerned about temper tantrums on his beat; and the underworld praises the thief. Thus the same behavior pattern is a problem to one social group but not to another. The conclusion must be that problem behavior can be so judged only in the light of social norms. Exactly the same things are true concerning that behavior which is not socially disturbing, for example, withdrawing, fear, or jealousy. The shy, timid, quiet child is welcomed by some teachers because he causes no trouble, and there are parents who actively foster such behavior in their children. Here the norms which are violated are mental-hygiene ideals which, unfortunately, are not always widely known except by persons professionally interested and trained. Trained persons recognize that this behavior is at least as serious as the actively disturbing behavior.

Conduct Problems. As noted previously there are a group of behaviors which are disruptive of good order and social harmony if not frankly in violation of mores or legal codes. Here we find such things as fighting, disobedience, profanity, lying, open defiance, assaultiveness, disruptiveness, temper tantrums, stealing, and poor relations with others. These behaviors rarely occur singly; more often a number of them characterize the behavior of the individual child. This constellation is frequently easily recognized by concerned adults; particularly those against whom such behaviors are directed. These behaviors seem to form a scale or

dimension so that the severity with which the constellation is manifest varies considerably among conduct problem children. The most severe child may be an aggressive, assaultive juvenile delinquent; the less severe child only an occasional, albeit noticeable, disruptive influence in the classroom.

Personality Problems. There is also a demonstrable group of problem behaviors which are not necessarily socially disturbing or norm-violating. This cluster is characterized by such traits as withdrawal, submissiveness, anxiety, worry, fear, feelings of inferiority, and lethargy. This sort of problem behavior comes less readily to the attention of others since it is frequently troublesome only to the child himself. Here again, there is considerable individual variation in severity among those considered to have a personality problem.

As might be expected, conduct problem cases are more frequently referred to the clinical psychologist. However, as mental health principles become more and more widely disseminated this is becoming less the case. It is also true that boys outnumber girls very nearly three to one in referral for problem behavior. Just why this is so remains an unsolved problem.

Individual Study Is Imperative. While there is accumulating evidence linking the two types of problem behavior to different kinds of environmental experience the study of specific antecedent conditions remains necessary in each individual case. The need of knowing the causes of a particular problem in a particular child may best be shown by two cases in which the complained-of behavior is similar, but which from the point of view of etiology are quite different. In both of these cases the referent was disturbed because the children lacked confidence, withdrew from usual contact with other children, and exhibited fear. In both cases the problem was evident in school adjustments. On the basis of the behavior alone both would have to be classed in the personality problem group. Information concerning the history of the two children, however, clearly shows the difference between them. One case, a nine-year-old boy, came from an economically and socially superior home. The father, however, was extremely timid, both in his own behavior and in his expression of concern over his son. The boy was always being supervised by the mother or father. No rough play was permitted. Both parents

constantly cautioned the boy against getting hurt, and they encouraged him in his overcautious attitudes. With this sort of environmental influence it is little wonder that the boy lacked confidence and avoided close contact with his classmates.

The contrasting case was a high-school girl who came from an immigrant home of low economic and social level. The parents spoke only the foreign tongue of their home land. The girl spoke the foreign language also, but earlier in her life she had learned English as spoken in her own foreign community and with a very pronounced accent. About the time she was to start high school the family moved from the foreign neighborhood so that the girl had to attend high school with children who did not speak her sort of foreign-accent English. The other school children teased her and did not accept her. Her reaction to this environmental influence was to avoid the other children. She withdrew from contacts, lost confidence in herself, became fearful of association with the other children.

In these two cases the net result in observable behavior was essentially similar. However, it is quite evident that they are entirely different problems. Without a very careful investigation of the children's histories, only the most significant points of which are briefly related here, it would have been impossible even to begin planning a method of helping them.

HISTORICAL BACKGROUND

The origin of the type of work that has been described and the term "clinical psychology" are the contributions of Lightner Witmer, who first proposed the possibilities of this sort of psychological application at the University of Pennsylvania in 1896 (Watson, 1953). Further impetus was given through the somewhat later appearance of psychiatric interest in the problems of childhood. These two approaches, the university-centered psychology and the medically oriented psychiatry, traveled their own paths for some time, and even now some points of emphasis and some differences in orientation exist. The psychological contribution in the development of tests, especially the original Stanford Revision of the Binet Test which appeared in 1916, led to an acceleration of the psychological study of individual children. The ap-

pearance of the group test, roughly coincident with and given great impetus by World War I, resulted in considerable advances in applied psychology. Unfortunately, however, the group test's ease of application and relatively large returns of information per unit of time caused a temporary relative abatement of interest in the more cumbersome and more difficult-to-apply individual test. With the realization that the group test was not a substitute for the individual test and that the latter supplied much information that a group test could not give, interest in the individual test—never, of course, entirely dormant—was revived. Then, too, emphasis on the case study as a whole, not merely psychometric findings, resulted in the restoration of the original clinical methodology described in the previous sections of this chapter. World War II and its aftermath served to accelerate these trends already in operation. Today over one-third of the present 25,000 psychologists function as clinical psychologists (Ross and Lockman, 1963).

TRAINING

Just as it is in other professional fields, training in clinical psychology is confined to the graduate level, the prerequisite for entry to which being the bachelor's degree. Training in both general psychology and in the specialty are required. Customarily four (or more) years are spent in graduate school. The first year of training often is not very much different from that received by other erstwhile psychologists, in experimental psychology, social psychology and the rest.

Clinical training consists both of course work and clinical experience in the topics considered in this chapter—diagnostic appraisal, psychotherapy, research, and the like. Clinical experience is first obtained at a clerkship level, generally during the second year of training, taken along with coordinate relevant courses. Typically about two days a week are spent in a hospital or clinic where the student begins to learn the tools of his profession under the supervision of staff psychologists.

The third year most typically is spent full-time as a so-called intern in an approved training facility. Again one is trained by actually working with patients. The fourth graduate year is most often devoted to preparation of the Ph.D. dissertation—a piece of original research carried through to

completion, along with advanced seminars. On securing the Ph.D. degree the clinical psychologist is ready to begin his professional career.

ORGANIZATIONAL ASPECTS

As clinical psychology became professional in nature, it took on the characteristics that are associated with a profession. A profession is distinguished from other occupations in that its specialized activities are carried on by practitioners who cannot be properly evaluated as to their competence by people without that same specialized training (Hughes, 1952). As in all professions, the activities they carry out have important consequences and do not necessarily work out to the patient's or client's benefit. For example, somebody always loses in a court of law, and death eventually wins over us all. In a sense then, professions cannot always satisfy their clients or their relatives. This makes an impartial source of judgment of competence imperative. Professional activities are the very ones that the individual cannot carry on for himself. In other words, the only competent judge of the quality of the work of a lawyer would be other lawyers, of a physician that of other physicians. The essential characteristic, then, of a profession is that practitioners judge the competence of their fellow practitioners. The public, moreover, need protection from quacks, those individuals who take upon themselves competencies which they do not possess and offer their services as if they did in fact have the appropriate skills. For these and other reasons a series of professional organizations have been set up to help in establishing levels of competence to practice clinical psychology.

The American Board of Examiners in Professional Psychology issues diplomas to those who qualify, not only in clinical psychology but also in counseling psychology and in industrial and engineering psychology (see Chapters 18-19). Five years of relevant experience as judged by the Board admits a clinical psychologist to candidacy. If successful in a written examination, he is given an intensive oral examination, involving samples of his work in diagnosis and disposition (treatment), and the ethical and professional attitudes and knowledge. The successful candidate, "the diplomate," as he is called, is privileged to refer

to this attainment in connection with announcement of his services.

Primarily in order to protect the public against misrepresentation, a considerable number of states have passed laws certifying or licensing psychologists who wish to practice, including practice in clinical psychology. In a manner akin to the certified public accountant, a certificated psychologist is the only one permitted to make that claim. Others can call themselves "psychologists" in states with such laws but cannot claim to be certified, without risking prosecution. Some states have a law which protects the term "psychologist" by requiring a certificate for a person to use it. Licensing, in contrast, defines the activities of a psychologist and forbids any one to carry on these activities without having the license. Training of the sort required for the diploma but somewhat less experience of a satisfactory sort are two of the major requirements used in these states.

PSYCHOLOGICAL SERVICE IN CLINICS AND INSTITUTIONS

A question frequently asked by students is "Where does the psychologist do the sort of work you have described?" A plausible approach in answering this question is to consider briefly the kinds of clinics and institutions where the mentally retarded child, the juvenile delinquent and behavior problem child, the adult psychotic, the vocationally undecided adolescent, the neurotic veteran, the nonreading boy, and the college student with feelings of inferiority may be seen professionally by the psychologist. The inference should not be drawn, of course, that professional help in regard to each of these problems is received only at the agency described. Many of the organizations are concerned with many of these problems of adjustment. But the individual agencies tend to find more of their cases drawn from those who exhibit one sort of difficulty of adjustment rather than another. Moreover, there are also private practitioners who may, or may not, specialize in one or another of these problems.

The mentally retarded child is often brought to the attention of a psychological clinic attached to a university or state agency. Once he has been referred to the clinic by parent, physician, social agency, or school system, it is the function of its

staff to diagnose the problem and to make suitable recommendation for disposition and treatment. Placement in an ungraded class where training suitable to the child's ability will be given while he still lives at home may be recommended. If the retardation is severe, or if social inadequacies of adjustment are present, such as stealing or the possibility of physical harm to others, then placement in a private or state institution might be recommended. These "training schools" as they are often called, also have clinical psychologists on their staffs. They help to verify the appropriateness of the decision for placement, and plan the kind and level of training and work most suitable for the child's capabilities as they have established them. From time to time they also check the progress being made. Contrary to popular opinion, some individuals institutionalized as mentally retarded are helped enough so that they can return to society, even though close supervision may still be necessary.

Juvenile delinquents or children with any of the problems described earlier are often referred to a child guidance clinic, either by parents, by school authorities, or by the courts. During the course of treatment they continue to live at home and attend school or go to work, rather than being institutionalized. Clinics characteristically function in this fashion as distinguished from hospitals.

The unique feature of most child guidance clinics is the use of a team of specialists in their work in diagnostic appraisal and treatment. There is apt to be a flexible division of labor among the professional personnel involved. Psychological testing is one of the provinces of the clinical psychologist. The psychiatric social worker is concerned with securing information about the environment from which the patient comes. Overall planning, relatively more of the treatment procedures, and often clinic management are among the tasks of the psychiatrist. When the diagnostic information has been secured there is a case conference to pool what they have found and to plan the strategy of treatment and to choose a therapist. In many clinics psychotherapists are drawn from all three professions, so that typically the clinical psychologist "carries" cases in treatment, along with his diagnostic duties. Often a therapist is chosen not only for the boy or girl in question but also another one for a parent (generally the

mother) since, all too often, it is found that the home situation is contributing in some way to the child's difficulties of adjustment. If this source of difficulty is ignored, the child would be subject to many of the same pressures which brought on his difficulties originally, and treatment would be enormously handicapped.

In the mental hospital, private, state, or federal, the psychologist functions as a specialist under medical supervision and as a member of a clinical team. In such a hospital the majority of patients are suffering from one or another of the so-called psychoses described in Chapter 14. Some hospitals have all newly admitted patients examined by psychologists; others use the staff of the psychology section on the basis of referral of the patients for some special purpose. Whatever the organization, the purposes of psychological examination are substantially the same. Differential diagnosis, as in the illustration of the psychotic who had been previously judged mentally deficient until his test pattern revealed discrepancies of which a mentally retarded individual would be incapable, is an increasingly important function of hospital clinical psychology. Establishment by the Rorschach Test of clinical signs that differentiate patients showing organic changes in the nervous system from those showing substantially the same behavior in functional disorders in which there is no observable structural change is another illustration of differential diagnosis by use of psychological tests. A closely related problem is the examination of the patient for the purpose of deciding what form of treatment is apt to be most effective. For example, intelligence at least at the dull normal level is necessary if insight therapy of a thoroughgoing sort is to be applied. The severity of the disorder from which the patient is suffering may be in part judged by the severity of the "signs" revealed in testing. Lest, however, the conclusion be drawn that these piecemeal approaches represent the most important contributions of the psychologist, it must be emphasized that his major professional contribution is the personality analysis in which the focus of the examination is upon using psychological resources for the development of professional insight into all the forces which make the patient the unique individual that he is, that is, the case study in its fullest sense.

Problems of vocational, educational, and per-

sonal nature come to the attention of workers in guidance and student personnel, either in secondary and collegiate educational institutions or in private counseling agencies. Group tests are used more often than individual tests, especially those measuring interest, intelligence, aptitude, and achievement, and the emphasis is likely to be on the solution of some specific problem, such as vocational choice, rather than upon a complete personality study, although this occasionally is carried out. Indecision in regard to vocational plans is a typical problem. The focus on the individual characterizes the clinical as opposed to the group approach in guidance programs.

Psychologists attached to school systems often encounter the student who has specific subject disabilities, such as reading disability. Along with the usual psychometric instruments, the school psychologist applies reading diagnostic tests and, on finding the apparent causes of the difficulty, plans a remedial program. This often takes the form of special tutoring, generally conducted by special or regular classroom teachers. The psychologist serves most often in a consultant capacity, checking on progress from time to time. Other major problems that concern the school psychologist are the degree of educability of the retarded child, behavior and habit adjustments, and vocational guidance.

Various colleges maintain mental-hygiene clinics directed either by psychiatrists or by psychologists concerned with those minor deviations from the normal, present in many otherwise normal individuals. The student with feelings of inferiority is illustrative of one type of problem. Explanation, persuasion, and reassurance of a supportive character are often used therapeutically, although some clinicians try a more nondirective approach. Often there is less emphasis on psychometric testing than is the case in other agencies. The emphasis here, as implied by the very title, is on the prevention of more serious abnormalities by early treatment.

Private practitioners in clinical psychology depend for their livelihood upon the fees paid by their patients. Only a small proportion, say 5 per cent, of clinical psychologists are in full-time private practice, but a considerably larger proportion have a part-time practice in addition to their institutional work. Private practice is considerably stronger in certain states, such as New York or California, than it is in other areas.

This necessarily brief enumeration is by no means complete. Psychologists are found in general, neurological, and tubercular hospitals, agencies for the rehabilitation of the physically handicapped, nursery schools, family and marriage counseling centers, industrial concerns, schools for the deaf and the blind, VA guidance centers, prisons, and old-age counseling centers, as well as in private practice either as general practitioners or as specialists in one of these functions. The common thread unifying the endeavors of all clinical psychologists is their application of the clinical method of diagnosis and treatment for the purpose of solving or alleviating problems of human adjustment.

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CHAPTER 16

Educational Psychology

Psychology is more widely applied to education than to any other field of endeavor. Its facts and principles are of value not only to those who enter the field as their profession but also to others who, as students, are interested in their academic progress; as parents, are concerned with the development of their children; and as citizens, have a responsibility for the effective conduct of the schools.

WHAT IS EDUCATIONAL PSYCHOLOGY?

DEFINITIONS

Educational psychology can be defined in various ways. In general, it is an applied science, the basic science of psychology used to help solve the practical problems of education. Analogies would be biology in medicine, and physics in engineering. Its content includes whatever psychology may be useful educationally, whether facts, techniques, or theories. As a discipline, it is a set of interrelated facts and principles of behavior with the emphasis on learning, and mediated through teachers, parents, and others, most of whom make no pretense of being educational psychologists. And as a profession, it is the practice of psychology in an educational setting.

An educational setting is one made up of human beings, children or adults, who are present for the purpose of learning, not rats, monkeys, or pigeons, although animal experiments often provide valuable insights into human behavior. Unlike a controlled laboratory setting, it is afflicted with multiple variables, though teaching machines and programmed learning make possible a more perfect control than was heretofore possible. The educational setting involves on-going activity and, more often than not, social interaction, and implies specific goals, general objectives, and a hierarchy of values.

The goals, objectives, and values reveal the nature of the learning that is expected to take place, the changes in response patterns sought, what is sometimes referred to as the output or terminal behavior of the learner. Their attainment

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depends on the psychological knowledge and techniques that may be used to control the educational environment and assess and evaluate the outcomes. Thus the teaching task, psychologically viewed, involves a prediction of what behavior to expect under varied conditions, the selection and control of influential variables, and the attainment of pre-established objectives. The school psychologist's function is to assist the teaching staff by giving the attention needed in more difficult cases, employing tests and other evaluative devices, counseling with pupils, teachers, and parents, and making recommendations concerning the placement and treatment of pupils.

Educational psychology, then, consists of professional knowledge and skilled performance. It is the knowledge of human behavior involved in providing effective environmental control in order to produce desired behavioral changes, and the techniques employed to assess and evaluate such changes, particularly in children and young people in educational institutions.

SOURCES

As might be expected, the facts and principles of educational psychology have evolved from both psychological and educational sources.

The British Associationists. Philosophers long included education (pedagogy) within their province, as well as psychology. Aristotle had enunciated the principles of the association of ideas which were later elaborated by Berkeley, Locke, Hume, the Mills, and others. (See Rand, 1912.) On them E. L. Thorndike (1914, 1932) based his laws of learning, and from them and from the anecdotalists' reports of the intelligent action of cats and other animals (Romanes, 1884) he devised the first experiments in animal learning, employing the maze and the puzzle box. The basic principle, contiguity, is found in conditioning; and the supplementary factors such as recency and frequency, are implicit in Skinner's (1957) reinforcement contingencies and have a long educational history as review and practice or drill.

*The European Empiricists.*¹ Quite a different source is to be found in the principles and school practice growing out of the theories and intuitions of the great European educational reformers. The story of *Émile* (1762), famous brain child of the

French Swiss Jean-Jacques Rousseau, and his freedom to grow in accordance with nature influenced a great many people. Among them was the German Swiss, Johann Heinrich Pestalozzi, whose *Leonard and Gertrude* (1781) and *How Gertrude Teaches Her Children* (1801) illustrated his aim as he stated it: "I wish to psychologize education." Rousseau's dependence on nature and his own prophetic insight are seen in the statement, "Whatever, therefore, man may attempt to do by his tuition, he can do no more than assist in the effort which the child makes for his own development." He expounded the ideas he worked out chiefly in his school and teacher-training institute at Burgdorf and at Yverdon. He emphasized the need for friendly pupil-teacher relations, in contrast with the harsh practices then in vogue. He rejected what he called "the empty chattering of mere words," which he believed characterized the education of his time, and substituted an emphasis on sense impressions and observation, and on the orderly development of the child's instincts and abilities, of proceeding from the simple and concrete to the complex and abstract. His teachings were embedded in the nineteenth-century American normal schools and teachers colleges, as were later those of Herbart.

Johann Friedrich Herbart was for some time professor of philosophy at Königsberg where he established a small practice school. He supplemented Pestalozzi's concern for geography, numbers, and language with an emphasis on history and literature. He was less an intuitive social reformer and more a scholar who attempted to organize education on a scientific basis. He believed that the function of education was to develop moral character and social usefulness, and so enable man to live more effectively in an organized society. Hence a many-sided development was necessary, which underlined the importance of effective instruction. Herbart rejected the faculty psychology of his day in favor of the concept of the mind as a unity, and elaborated a principle of apperception according to which the learner assimilates new knowledge in terms of what he already knows. From this concept came his concern for interest, and for the correlation of studies with a central concentration later referred to as a major. And from it, too, were derived the so-called formal steps in teaching an inductive lesson:

¹ See, e.g., Boyd (1950), Cubberley (1934), Gage (1963, Ch. I), Good (1947), Monroe (1921).

1. *Preparation*—gathering previous knowledge relating to the new topic.

2. *Presentation*—exposition of the new; discovery of a general idea.

3. *Association*—combining the new with the old; the relatedness of ideas through apperception.

4. *System*—separation of the general idea from concrete particulars.

5. *Application*—fusion with on-going experience.

These steps were faithfully taught and practiced in American teachers colleges until the conversion of psychology to the study of behavior and of education to activity ushered in the problem and project methods and so tended to break down this more formal mentalistic approach. The steps, however, still have practical value, especially with the "object teaching" which audiovisual materials provide, and there is no doubt that much instruction, particularly the lecture demonstration provided by television, would profit from the use of this technique.

Friedrich Froebel, who had spent two years as a student and teacher at Yverdun, conducted a Pestalozzian school for ten years and wrote his views in *The Education of Man* (1826). He was particularly enthusiastic about the educational value of play, games, songs, and occupations involving self-activity. He recognized the importance of object teaching and perceptual discrimination which later found expression in school laboratories and shops, and in the use of audiovisual aids. He made much of the importance of natural growth processes, hence the name he gave to the institution he founded, the *Kindergarten*. He had thought of naming his school a *Kleinkinderbeschäftigungsanstalt*, but wiser counsel prevailed. The word means small children's activity institution, however, and therefore stated the principle of "learning by doing" later elaborated by John Dewey.

The contributions of Pestalozzi, Herbart, and Froebel were educational psychology, and not of the armchair variety either. They tried out their hypotheses not on lower animals or college students but on the same kind of live, active children as those to whom they applied. Such idea schools, operated on the basis of certain theories of child nature, spring up from time to time under the guidance of some gifted and dedicated leader.

Other illustrations are Paul Geheeb's *Odenwaldschule*, which influenced the development of the *Schullandheim* and *Landerziehungsheim* and formed a kind of model for democratic Germany. There were the Roman Children's Houses of Marie Montessori which made much of sensory discrimination and led to the individualized instruction Washburne introduced at Winnetka and to Helen Parkhurst's Dalton Laboratory Plan, and served to break down some of the rigidity that had overtaken the Froebelian Kindergarten. There was Tagore's Santiniketan, which inspired changes in the educational program for an independent India. In England (see Armytage, 1964) there was Pyke's short-lived Maltinghouse School in Cambridge, fathered by C. S. Sherrington, from which Susan Isaacs and S. R. Slavson received their inspiration. J. H. Badley's Bedales, unashamedly coeducational, and Sanderson's Oundle, highly praised by H. G. Wells, with its farms and gardens and determined nonsectarianism among public (private) schools with a reputation for caning as an antidote for original sin.

These, together with other factors are responsible for producing recent and imminent reforms in English education but not quite quickly enough to restrain some misguided American critics from glorifying English schools for qualities the English themselves are trying to change.

In the United States, the first English-speaking Kindergarten was started in Boston in 1860 by Elizabeth Peabody, one of whose sisters had married Nathaniel Hawthorne and the other Horace Mann. The first public school Kindergarten came thirteen years later under the superintendency of the eminent educational philosopher-administrator William T. Harris of St. Louis. Now a recognized part of the American school system, it has lost some of the formalism of Froebel's original "gifts" and "occupations," but its substance has continued to influence education at all grade levels.

Often protests against the seemingly necessary formal educational procedure of the day, such private educational efforts both at home and abroad have had no little effect on the regular schools. And where the latter are more or less impervious to change, they have affected the development and programs of extracurricular activities and of youth organizations of this and other lands. Unfortunately it was never possible to discover exactly

what the effects of such efforts were since experimentation and scientific methods of assessment were lacking.

The Experimentalists. Early experimentation in psychology had little concern for application but was largely confined to theory and introspective methods. The contributions of Wilhelm Wundt, the "father of experimental psychology" who established the first psychological laboratory at Leipzig (1879), and his successors in this country, notably Titchener of Cornell and Cattell of Columbia, were largely confined to sensation and feeling, the elements of conscious states (the structural school), and to reaction time and set, which had been carefully studied by the Würzburg group. James, Angell, Judd, and others (the functional school), with their interest in the nature of conscious *processes* instead of the structure of conscious states, opened the way for later applications. The objective experiments of Ebbinghaus on memory (*Ueber das Gedächtniss*, 1885), though performed on himself with his invention of the nonsense syllables, stimulated a great deal of work on serial learning, which seems thus far to have more theoretical than practical value.

The voluminous experimental contributions of E. L. Thorndike followed the associationist tradition, as has that of B. F. Skinner though sparked by a more enthusiastic behaviorism. This would gladden the heart of John B. Watson (1924, 1925), its pioneer popularizer, and also that of I. P. Pavlov (1927, 1928) whose concept of what is now called classical conditioning laid the groundwork. Thorndike considered it a special case of associative shifting in contrast with the trial and rewarded success of his early experiments, now called instrumental conditioning.

The Berlin school of Gestalt psychology, whose members one by one migrated to America—Wertheimer and his pupils, Köhler, Koffka, and Lewin, elaborated what was once loosely referred to as the stimulus situation and part-whole relationships. (The German word *Gestalt* is variously translated *form*, *pattern*, *configuration*, and even *arrangement*.) Köhler's (1926) famous, nonquantitative chimpanzee experiments on problem solving, and Lewin's (1951) social psychology experiments on group processes were rich in suggestions for instruction in class and group situations. New words were added to the pedagogical terminology—in-

sight (cognitive reorganization), pattern, configuration, structure, valence, barrier, individuation, closure, and others. As a consequence, learning, particularly in areas of perception, motor skills, and problem solving is differently viewed than it would otherwise have been.

The Psychoanalysts. The doctrines of Freud, Jung, Adler, and their successors likewise have important educational implications. Derived from French psychiatry and British associationism, but based on the concept of a dynamic unconscious mind, they have served to provide a rationale for the diagnosis and treatment of neuroses and various personality disorders that afflict children as well as adults. The extremes of Freudian psychology have found little acceptance in education, and the prolonged treatment it prescribes, running into months and years, can hardly be provided at public expense. Nevertheless many of its tenets, chiefly through the influence of the mental hygiene movement, have affected school practice as well as clinical procedures. In both counseling and teaching, account is taken of the defense mechanisms, and also of Adlerian compensation and Jungian introversion-extraversion, and of many of the pronouncements of the neo-Freudians. And teachers are trained to handle troublesome cases in other ways than by indiscriminate punishment.

The Psychometrists. Although James McKeen Cattell, a student of Wundt, is credited with first using the term *psychological test*, his psychophysical devices have enjoyed less educational popularity than the items empirically developed by Alfred Binet (1911) and revised and adapted in the United States by Lewis M. Terman (1916, 1937 and 1960). David Wechsler's individual tests draw heavily on the Binet scale, as do the tests by Terman, Thorndike, and others designed for group administration, first extensively used during World War I. Revisions adapted to school use are administered as a matter of routine, as are the standardized achievement tests. Besides aptitude and achievement tests, other instruments of measurement often used include questionnaires, personality inventories, and more recently the projective tests. When Galton borrowed the concept of probability from the racetrack and the casino, and Gauss produced the mathematical probability curve named after him, the way was open for the development of statistics as an instrument for

handling test scores and for developing and testing hypotheses involving measured variables.

In this country, the first school psychologists were those who administered the Stanford (Terman's) Revision of the Binet scale, obtained the mental age score Binet had invented, and computed what Stern had called the intelligence ratio, but which came to be called by the name that Terman gave it, the intelligence quotient or IQ ($MA/CA \times 100$). But now, although the psychometrist (some prefer psychometrician, diagnostician, or examiner) may devote himself to this work, the school psychologist will have additional responsibilities: selecting tests, developing a testing program, counseling with children, teachers, and parents, and treating or recommending treatment for those who for various reasons may not be doing so well in school as it is believed they might. More recently the middle and upper ranges of intelligence have been the subject of scrutiny by educational psychologists and others, particularly the academically talented (superior, gifted) for whom various adaptations of the school program are being evolved.

Summary. Thus educational psychology as it is known today includes the contributions from five fairly distinct sources: the philosophers, particularly the British associationists, the European Empiricists, the psychological experimentalists (structural, functional, and later, behavioral and configurational), the psychoanalysts, and the psychometrists. Many present-day educational psychologists tend to favor one or another of these approaches, although most of them are inclined to use whatever combination seems most helpful for a particular educational problem. Eclecticism is the rule rather than the exception.

CONTENT AND PROBLEMS

For this brief survey of educational psychology as it developed from its five sources, it will be convenient to note five areas of study and investigation which may be outlined as follows:

The Subject (S), variously called the learner, student, pupil, the individual, and the organism—what is known about him and what should be known in order to adapt instruction to his interests, abilities, aptitudes, and needs.

The World (W), the subject's or learner's environment or life space that impinges on him in the form of sensory stimulation, parts of which

he seeks or avoids, and parts of which are brought to him for instructional purposes—things, words, people, symbols, the curriculum, what must be regulated if he is to learn what it is desired that he learn.

The Observer (O), the teacher, researcher, coach, director, evaluator, the more mature person or persons—people who are expected to observe the Subject and his World (and also themselves) and modify the Subject's behavior by manipulating various parts of his World.

The Responses (R) of the Subject—his behavior and the changes made and to be made in it; also, the teaching and corrective responses of the teacher (*O*), the instruction and cues for the learner derived from *W*, *S*, and *S*'s Responses that come as feedback to *S* and *O*.

The Memory (M), stored knowledge available for later use—the retention and selection processes which make repetition possible, which change from trial to trial, and which, as experience, provide the basis for thinking and problem solving.

Both the subject (learner) and the observer (teacher) must keep an eye on the environment. The observer must also carefully note the learner's responses and his own. All the responses (*R*) and their consequences serve as feedback both to the learner (*S*) and to the teacher (*O*), so that the memory (*M*) function enables the learner (*S*) in subsequent trials and in similar situations to make the same or perhaps improved responses.

THE CURRICULUM

Since the world in its entirety cannot be brought to the pupil, some selection must be made. Owing to the influence of such factors as health, character and occupation of parents, race, religion, social and community groups, nationality, climate, and so on, the effects of which have all been given careful study, there are many different opinions as to what is desirable for inclusion in the curriculum. In what activities, intellectual or other, should the pupil engage? The proper nature of the curriculum during the 1950's was the subject of rather animated debate, and lay opinions were often enunciated with a vigor that was quite out of proportion to the meager information on which they were based. Views were expressed as to the comparative value, say, of the social sciences, the social studies, and "home and family living," of science and the humanities, and of

theoretical and practical studies, and so on. As long as a society is dynamic, such questions as these will recur, and changes in the curriculum will be made in harmony with the temper of the times.

Actually the curriculum in American schools represents a vast collection from many sources, initially the seven liberal arts of the medieval period: the *trivium* (grammar including some literature, rhetoric including a little history, and dialectic) and the *quadrivium* (arithmetic, geometry including the rudiments of geography, music, and astronomy including rudimentary physics). The language of instruction was, of course, Latin, and the Renaissance brought an enthusiasm for Greek classics. Hence the later college requirement of Latin and Greek after they were no longer needed. They became prestige subjects, often studied by those who could make no use of them.

Recommendations of national and state committees have influenced legislators and local boards of education to add and subtract accordingly as the needs of the country and of young people were perceived. Parents and other community members have had their say, as have the subject-matter experts, textbook writers, curriculum specialists, educational theorists, scholars and scientists, and a vast array of philosophers. The educational psychologists as educators are naturally concerned with all the above influences. As psychologists they are concerned with satisfying the needs of students as individuals and as future members of an adult society. They are also most vitally concerned with adapting the student's school program to the nature of his interests and the level of his aptitudes. In this respect practically all schools have been derelict in their duty. The commonly accepted system of grade promotions has forced great numbers of learners to undertake useless tasks often either too difficult or too easy for them with the unfortunate consequences that are likely to accrue. The most important challenge to educational psychologists today is not so much the selection of students for certain levels of instruction as it is the selection of subject matter that is adapted to their abilities and needs.

THE SUBJECT OR LEARNER

It is generally assumed that the more a teacher knows about a pupil the better. The old-time

teacher knew his student's parents, his brothers and sisters, the part of town he came from and the crowd he consorted with, and made allowances accordingly. A teacher today knows or can know the student's intelligence and achievement scores and previous school marks. In addition he may know the socioeconomic level of the home, and also quite a bit about the psychology of children of the age he is teaching, though he may not be quite sure about what to do with this knowledge. In practice, however, instead of merely having to read about and report on children's characteristics, as he did in his college education courses, he must recognize those characteristics in the pupils themselves, and what is more difficult, *do* something about them. And what he does, as he well knows, should contribute to the pupils' knowledge and skill and also to their individual and social development. What are the things it is considered useful to know about the children he is expected to instruct?

THE DYNAMIC ORGANISM

Perhaps the most important knowledge he should have grows out of the realization that children are dynamic organisms. In reporting her interview with a school counselor, one mother said she didn't like the way he kept referring to her child as "the organism." One can sympathize with her point of view; it is possible to think organism and say child. A great deal of speculation and, more recently, experimentation has been devoted to describing the dynamics of human behavior. The terms used reveal their sources to the psychologist: instinct, drive, motivation, goal-seeking, delayed response, want, need, frustration, barrier, valence, and more specifically, aspiration level, unfinished task, catharsis, compensation, sublimation, and others.

Many of these terms are explained in other parts of this volume. Suffice it to say here that educational motivation depends on such factors as readiness, set, previous preparation, primary and derived needs, sometimes unconscious, sometimes taking the form of interests, and also on social pressures in the form of sanctions by the home and by the peer group. Not only does drive and motivation differ in different individuals, but tolerance of frustration also varies, and so do the forms which frustration behavior may take. All these factors need to be considered particularly in

dealing with problem cases. On the other hand, it should not be expected that all students will ever be highly motivated to pursue all the school subjects with equal enthusiasm.

But adaptations can be made on the basis of knowledge of the student's home conditions, personality makeup, and general and special abilities, so that the school program at least will not make matters worse, and hopefully that his adjustments in his school and attitudes toward it will improve. Teaching skills will contribute to the desired end, although some more difficult cases will be referred to the school psychologist, perhaps to a psychiatric clinic.

Health factors and physical handicaps also receive attention. Sometimes these are obvious, sometimes quite elusive, and children may be disciplined for behavior that is caused by physiological deficiencies such as low basal metabolic rate. Special teachers are trained to deal with those with visual and auditory defects and with the mentally handicapped and emotionally disturbed in order to adapt the program of instruction so far as it can be done, to their individual needs.

GROWTH AND DEVELOPMENT

The psychological interest in growth lies primarily in the characteristics of different stages of development, physical, mental, and emotional, while the educational concern is for the curricular and instructional needs of persons at different ages.

Growth Stages. The so-called cross-sectional studies provided the information earlier available concerning child growth and development. Tests were given to all the different grades and a growth curve was drawn by connecting the mean scores of students for each grade. But such measures told little about the developmental characteristics of individuals. An important step was taken when the same children were measured in successive years.

Arnold Gesell (e.g., 1940) tested and described behavior and developed behavioral norms at the earlier age levels. Parents comparing their children's growth with these norms were sometimes disappointed, not realizing that Gesell had used a small sample which did not fully indicate the range of normal growth nor growth irregularities. Willard Olson (1959) combined mental and physical meas-

ures using age scores for intelligence, reading ability, height, weight, strength of grip, dental development, and carpal ossification. He found that the curves for any one child tended to parallel each other and concluded that growth is a unitary process. With an adequate environment, forced instruction is of relatively little value provided there is opportunity for self-selection on the part of the pupil. These findings harmonize with the conclusions drawn from earlier intelligence testing and the intuitions of the mental hygienists.

Havighurst (1953) evolved what he called developmental tasks which confront an individual at different age levels as a consequence of being a dynamic organism living in a society. These tasks, which take different forms for different ages, are the following: (1) learning to care for and use the body in an effective fashion; (2) getting along with age mates in a constructive pattern of social interaction; (3) learning an appropriate male or female social role; (4) acquiring a set of values and an ethical system as a guide for behavior; (5) achieving personal independence from controls by others; and (6) learning appropriate social attitudes toward institutions and social groups.

Piaget (1928) set different judgmental problems for children of different ages and drew conclusions as to the process of development or maturation, chiefly of cognitive functions, and the ages at which certain competencies might be expected.

All these and other studies reveal the idiosyncratic nature of human growth, differing as it does not only from one individual to another, but also for different traits within any one individual. They further suggest the desirability of even more vigorous efforts to provide for individual differences instead of trying to force all children of approximately the same age into the same mold.

School Treatment. In general, Americans have been loath to provide special classes for special groups of children. The principle of universal, free, compulsory education has sometimes been interpreted to mean the same education for all as giving assurance of true democracy. The fact that it takes some children much longer to learn to read than others resulted in nonpromotion in the early grades so that special concessions were made for those who used to be called idiots, imbeciles, and morons. The dull normal (IQ roughly 70-90) are penalized by having to attend regular classes even though they are unable to "keep up." Various

grouping and promotion schemes have been tried, but the problem is not yet solved. Now, following psychological testing, the mentally handicapped are sometimes differentiated as only *trainable* and as *educable*, and are placed in special classes or given extra help in regular classes.

To aid the handicapped in this way has seemed to most people more democratic than making similar provision for the superior or academically talented. American education with its common schools and comprehensive high schools has long rejected the idea of cultivating an intellectual elite. As a consequence, a cult of mediocrity has held back brighter children, and a "gentleman's grade" of C was sufficient in college until Russian science produced an awakening. Various devices have been employed to break up the lockstep, or the convoy, in which the fastest proceed at the same rate as the slowest, and to accelerate those students who give evidence of talents that require long training and which give promise of making a genuine contribution to American society and to the wider culture as well.

Under the name *special education* schools are adapting to the needs of exceptional children, not only to the mental and physical deviates but also to the neurotic and the mentally and emotionally disturbed. It is to be hoped that eventually, instead of relying on remedial instruction, to make up for past educational mistakes, *all* education will be special education in the sense that it will be individualized sufficiently to adapt to the needs of all.

DIFFERENCES—TESTS

If there is any territory that belongs exclusively to psychology, it is that of the construction, administration, and interpretations of instruments designed to measure cognitive, emotional, and social behavior. These instruments are used primarily for prognostic or diagnostic purposes and for research.

Cognitive Factors—Aptitude and Achievement. Intelligence tests are perhaps the best known in the psychologist's battery. Whether for individual or group administration, they are designed to measure the innate abilities by measuring how much each has profited by the opportunity to learn. Since all have not had a completely equal opportunity to learn anything, and since rates of growth vary,

the results are not so precise as we could wish. However, the mental age (MA) as a test score does increase at varying rates, and when divided by the chronological age the resulting intelligence quotient (IQ) does tend to remain relatively constant in the great majority of individuals. The measure has been found to be a valuable one for classifying students and estimating how much may properly be expected of them.

Other aptitude tests are designed to measure the knowledge and skills needed for specific school subjects, such as French, algebra, or music, or entering certain vocations such as secretarial or social work. Obviously these tests cannot in all fairness ask factual questions on what a student has not studied, but rather on those things which require the same kinds of mental processes as the areas being tested.

Achievement tests, on the other hand, like the traditional teacher-made examinations, measure abilities in the different subjects that have been taught in school. The difference is that they have been standardized. This means that they have been tried out beforehand on representative populations, their reliability and validity ascertained and presumably found adequate, that administration and scoring procedures have been standardized and age or grade norms or both are provided. Since a measure of reliability indicates the degree of stability of a score, as it might be found on a second administration of the same test to the same students, and since a measure of validity indicates the degree of assurance one may have that a test measures what it is supposed to measure (not handwriting for a history test, for example), scores are more nearly comparable than on teacher-made tests, especially by the use of the norms or average scores of unselected populations for different age and grade levels. It should be emphasized, however, that such norms do not indicate the score any pupil *should* get, only the average of what a large number of widely differing pupils *did* get. What should be done about a student who gets a certain score, whether high, low, or average, depends on the purposes of testing, the level of other measures, his school performance, and other related factors. Standardization, of course, is not peculiar to achievement tests, but such tests most frequently bring the concept to the fore in school practice.

In spite of their recognized value, tests of

achievement have two related weaknesses. The raw scores are totals of right responses from a sampling of questions or test items, and so do not indicate what a student knows and what he does not know. And scores derived from norms are relative rather than absolute, and so do not show the degree of proficiency except as comparisons are made with other students of the same age or in the same grade. It should be possible to develop true proficiency scores comparable with time or distance measures in field and track events, or even with the less exact subjective judgments of musical performance that would indicate what a person's competence is whatever his age or grade, the number of accumulated credit hours, or number of years of study. Such measures would be particularly useful in fields where there is a fairly well-recognized progression, as in language, science, and mathematics.

Emotional Factors, Personality. Personality inventories, properly speaking, are not tests at all, but are questionnaires about themselves to which individuals are requested to respond. They call for introspections in the sense of observations and judgments about themselves (e.g., Are you happy most of the time?). Each response is tabulated and weighted according as the author of the test believes it should contribute to the personality characteristic he is measuring. This may be some matter of opinion or attitude, the subject's likes or dislikes, or the supposed components of such traits as introversion and dominance, or some matter of school concern such as motivation. Personality measures are not as a rule used routinely, like aptitude and achievement tests, but usually for clinical or research purposes. They are likely to be lower in reliability and validity, and there is even less certainty about the meaning of the resultant scores.

Projective tests are also usually used only for clinical or research purposes, to throw what light they can on baffling behavior disturbances. Most familiar, perhaps, but most difficult to administer is the Rorschach inkblot test, which permits the subject to project his own perhaps only partially conscious ideas and attitudes onto the essentially meaningless forms of the inkblots. The Thematic Apperception Test (TAT) is another projective test, one which instead of inkblots uses partially structured pictures of people. The subject's interpretations of what they are doing and their motives

often give a lead as to his personality make-up and furnish suggestions for possible treatment.

Social Factors, Ratings and Questionnaires. In recent years, sociologists and social psychologists have been turning up a wealth of valuable information hitherto largely overlooked by school people. Hence, consideration now is often given to such factors as social class and the difficulties of upper- and lower-class children in adjusting to what are essentially middle-class schools. The importance and nature of small-group structure has come to be recognized, including the influence of role and position (or status), the formation and behavior of cliques and gangs, the nature of the peer-group influence and of group leadership, and the location of the decision-making process. Information on such matters may be obtained by the pedagogically familiar device of rating, though the form taken is usually with a good-bad implication for report-card purposes. Ratings have usually been made of such traits as citizenship, cooperation, perseverance, and intellectual curiosity, although often too little care is taken to define either the traits or the scale points.

As an alternative to the rating technique, teachers, directors in custodial institutions, and others have been asked to report significant behavior (good and bad) of pupils or inmates, and what if anything was done about it. This so-called *behavior journal* technique is time consuming, but it has the advantage of providing anecdotal behavior data without value judgments, instead of value judgments without the behavior on which they are based, as is the case in rating. As few as a dozen or a score of such entries per child per year provides valuable information for guidance purposes over the years. Questionnaires have tended to follow the personality inventory technique except for Jacob Moreno's (1951) sociometric innovation, the sociogram, sometimes called the friendship chart. Subjects are requested to write down the names of the persons in the group with whom they would most like to sit, work, play, go on a picnic, and so on. Some are chosen frequently, the "stars," others infrequently or not at all, the "neglectees," and "rejectees." Results sometimes come as a surprise to teachers and often provide the occasion for breaking down the influence of undesirable cliques (clusters of mutual choices), and of assisting in the group acceptance of the friendless.

MENTAL HEALTH

An estimated 10 per cent of the school population is emotionally disturbed to a degree that their poor mental health interferes with their school progress. Most such children in the past have been treated by punitive measures, but more recently efforts have been made to understand the reasons for their condition and to employ preventive and curative measures. Needless to say these have not as yet been entirely successful. The number of hospital beds for mental cases, which is greater than for all other ailments combined, to say nothing of the maladjustments which increase the populations of the jails, prisons, and penitentiaries, demands that scientific efforts all along the line be continued and enlarged.

Undoubtedly many children would be disturbed and maladjusted whether they went to school or not. Authorities differ as to whether genetic or environmental influences are chiefly responsible. There is the suspicion, however, that the school experience does little to improve the situation and may in some cases make it worse. It is known that neurotic teachers have more children with neurotic traits in their classrooms than do teachers classified as normal. Furthermore, the effect of frustration on individuals is recognized, and in the academic tasks that are assigned, the frustration tolerance of many students is likely to be exceeded.

The schools have recognized their responsibilities and have sought to employ whatever psychology might seem to help. Naturally the psychologists have been called in. The Freudian defense mechanisms are generally known and recognized as symptoms for which the conditions producing them are sought. Anxiety and escape, hostility and aggression are known, the probable causes investigated, and efforts made to alleviate conditions, and to induce a change in the sufferer's perceptions of his world. Some cases are so severe that treatment takes precedence over any academic program. For others, a suitable academic program may be the best form of treatment.

THE WORLD—THE LEARNER'S ENVIRONMENT

The world of physical forces which impinge on the individual is commonly referred to as his en-

vironment, but also as his universe, and his life space. It is a very complex affair, as reported to him by his inner and outer senses.

VIEWING THE WORLD

The first thing an infant must learn is to make invidious distinctions, that is, learn to differentiate certain portions of his environment and discriminate between the parts that are important and those which are not. As he grows older he learns to make more and more distinctions, and the school helps him with additional ones, and also helps him learn what to do when confronted with any of these discriminated parts or combinations of parts.

Selection, the Percept. For convenience the environment may be divided into three parts: the world of objects, the world of people, and the world of arbitrary symbols (words and numbers). And although the school spends the most time on the last, discriminations in all three are vitally important. The primary instructional task is to see to it that learners are able to discriminate significant patterns of stimuli in these three areas, e.g., a red from a green light, a kind from a thoughtless act, a *p* from a *q*. And they must be able to identify either one when the other is absent. Such discriminations and identifications continue from the simplest sort that are usually picked up without formal instruction to the most complex identifications of art, personality, and science. They involve perceptual skills which the early educational theorists sought to develop through sense training and object teaching, and in which, with the multi-sensory aids now available, much more skillful instruction than heretofore can be provided.

Concept Formation. Merged with the perceptual processes are those of concept formation. Concepts represent classifications of parts within one or more of the three worlds, frequently recurring but not identical patterns. Thus the referents of each of the words *camel*, *smile*, and *equation* are various, but they provide a convenient method of grouping; and if finer distinctions are needed, qualifying adjectives can be used, e.g., young camel, enigmatic smile, or quadratic equation. The concept, however, is not the object as perceived, nor is it the word, for people have different concepts of the meanings of the same word, e.g., democracy, although for many words, especially technical terms, there must be agreement. In

fact one of the important functions of education is to see that learners do agree, that they build correct concepts, so they will know, for example, that prodigality does not necessarily involve eating veal, or that a dog fight does not necessarily imply canine participants. Without such agreement, communication would be difficult indeed.

Essentially, a concept is a common reaction to certain dissimilar stimuli. The learner must know what dissimilarities can be included and which cannot. For example, the letter *q* may be written in roman, italic, or gothic type, printed or script, capital or lower case, and with the variations of different kinds of handwriting, but it is still a *q*. But a small change like leaving off the "tail," is not permitted. Stimulus generalization is the name given to increasing the range of dissimilarity of stimuli to which the same response can rightly be made. Obviously, there are many opportunities for error ranging from a small child's calling all men "Daddy" to the supposition that the achievement of the students in two grade rooms can be compared by correlating their scores, or referring to or viewing the early stages of a communist development as merely agrarian reform.

Teaching Concepts. Opinions differ as to the best ways to teach concepts, although it is generally recognized that requiring that definitions be memorized is not sufficient. Sixth graders used to be taught that "a verb is a word that asserts," but few if any had the slightest idea of what is meant by "assert." Some advocate the heuristic method, the method of discovery, expecting the learner to figure out the meaning for himself and enjoy the experience of insight, if and when it occurs. Others advocate step-by-step instruction, pointing out the concomitant variations in the stimulus situation which do, or do not, permit it to be classified as a particular concept. Some point on the continuum between these extremes (called guided discovery, assistance, or directed learning) is generally favored. This places a responsibility on teachers to be sure that however much guidance is used, the outcome is correct. Unfortunately, the responsibility is sometimes evaded, a teacher being content merely to give the learner a low mark if he is incorrect, but allowing him to go ahead and graduate just the same, bringing his ignorance along with him. One of the most important but neglected educational problems is to determine

what students should learn and then following through to see that they learn it.

ENVIRONMENTAL INFLUENCES

A number of environmental variables that influence learning both positively and negatively are more or less under the control of the teaching personnel. These are the other pupils in the grade or class (the peer group), the curriculum (school subjects and activities), and the methods and media of instruction employed.

The Peer Group. It has generally been taken for granted that instruction involves a group of learners, though few ask whether this is because of economic necessity or the possibility that the presence of other learners helps each individual to learn. Certainly in team sports and musical ensembles a group is necessary for both practice and performance. But in learning reading, history, or algebra, for example, group members may well be a distraction. Yet practically all treatises assume the necessity of its constant presence with their references to *the teacher in the classroom*. They have apparently made a virtue of this assumed necessity, preaching the educational value of pupil participation, teacher-pupil planning, group problem-solving, and group projects. Moreno's (1953) sociodrama, the technique of role-playing, implies a group as of course does the traditional lecture. Group processes have been studied experimentally, especially intra-group communication and decision making, and group atmosphere has been classified by Kurt Lewin and his followers (1948) as autocratic, democratic, and laissez faire, with important implications for each.

Since so much of the world's work is done in groups, e.g., committees, boards, conferences, and assemblies, it seems important when the educational objectives specify the development of facility in group processes, that practice be undertaken in groups, just as the objective of being able to swim suggests the desirability of practice being carried on in water. However, the advantages of tutoring have long been recognized, as have the advantages of working by oneself at one's own rate. Other persons may be a distraction.

The Curriculum. In a sense, the curriculum is the selection from the world of the specific items that it is believed should engage the attention of the learner, be it art, mathematics, history, or

anything else. Viewed as subject matter by many, the curriculum is actually the series of activities of the learner. While the educational psychologist is not and should not be the sole arbiter of values in selecting the possible content, his professional judgment should help to determine its usefulness for stated objectives and the level of complexity or difficulty that is appropriate for different students. Chiefly during the 1920's educational psychologists exposed the specious claims of those using mental discipline as a criterion of selection. Furthermore their insights and questionnaires and tests have begun to guide the student in his individual choices.

Rate of progress and proficiency are matters of concern, and educational psychologists are now beginning to question the slicing of the curriculum into time segments, each to be "covered" in a day, a week, a term, or a year by all students whatever their ability. How much more sensible it would be to require an objectively stated level of proficiency, and when this is attained by any student, allowing him to proceed whether it has taken less or more time than expected. That is, instead of holding time constant and allowing achievement to vary, one could hold achievement constant and vary the time. Such an arrangement has interesting possibilities yet to be worked out.

Instructional Media. Teaching, as we have seen, is control of the environment of the learner so that he perceives the right stimuli and makes the right responses to them. The physical environment in the form of school architecture, except for some overcrowding, is developing appropriately. The social environment is supposed to be under control but often is not. A freewheeling principal or supervisor may barge in and mess things up for a while instead of helping, and there may be other interruptions. The other pupils, some of them at least, may cause distractions, and discipline, especially for beginning teachers, is likely to be a problem. Even in normal classrooms it has been found that a disproportionate amount of class time is taken up in giving directions or orders, scolding, reprimanding, and the like, instead of teaching. The recitation or other contribution of any one pupil may not be of value to the others, which means that instructional time is not being used effectively.

In spite of such difficulties in environmental

control, progress is made. Students do learn something. The standard media have long been a teacher's voice, questioning, explaining, and encouraging, and a textbook, each supplementing the other. More recently the audiovisual aids in rich array have been developed as adjuncts primarily in developing percepts and concepts, but they have often been in short supply and not conveniently available. Now the new media are on the point of providing a wealth of educational opportunity. The sound (language) laboratory, radio and television, and the self-instructional devices—programmed lessons and teaching machines—are causing educational psychologists and others to take a new look at the problem of control of the environment for instructional purposes.

EDUCATIONAL TECHNOLOGY

The new media of instruction, together with a number of other innovations, indicate that there is under way a speeding up of evolution, if not a real revolution (Trow, 1963). Education, of all major industries, is the only one that has resisted change so persistently. While many improvements have been introduced as a consequence of psychological thought and experimentation, the process is essentially what it has been for some 4,000 years or more—a group of young people to whom someone assigns lessons and punishes them for their mistakes.

From Mesopotamian Sumer about 1700 B.C. (Kramer, 1963) comes the record of the school for scribes in which boys were kept in after school, assigned useless tasks or flogged for such offenses as failures on their assigned oral and written work, not being properly dressed, talking or standing up out of turn, walking outside the gate, and unsatisfactory tablet writing. In some respects, we are still in the age of the ox cart.

First there was the one-room school, and then as wealth and school population increased new rooms were added, following a pattern that has been referred to as the "egg crate system." It has been assumed that equivalent rooms, each with its teacher and class, are essential elements even when evidences of the unsatisfactory nature of the arrangement began to appear in the form of shops, gymnasiums, auditoriums, and multipurpose rooms. There is a chance that the new media of

instruction will open the way for other badly needed reforms.

The New Media. Strictly speaking, tape recordings, television, and teaching machines are the new media (Trump and Baynham, 1961). The possibilities of tape-recorded sound extend far beyond its present use in the language laboratories, although even now with their play-back possibilities tapes constitute a means by which large numbers of students can be provided with the kind of instruction needed for oral language learning. Films, both still and motion picture, have been in use for some time but have not been adequately exploited, whether or not they are used in conjunction with sound. And through closed-circuit TV, video-taped lessons can be and are being broadcast over wide areas. Much more adequate lessons can be prepared than is possible with a heavy day-to-day teaching schedule. The chief difficulty with TV however is that the group must stay together and instruction is not individualized.

Individualization is taken care of in various ways through the self-instructional devices (Lumsdaine and Glaser, 1960). Whether presented by machine or in textbook form, they have certain definite advantages. There are two chief forms of programs with variations of each. The one designed by B. F. Skinner is a series of statements patterned after the Ebbinghaus completion test with a word or phrase omitted, e.g.,

The largest instrument in the string choir is the _____.

The student must write in the omitted word and then check it with the key by looking below or on the next page, or by pressing a key or turning a knob on the machine. The wording, preceding statements, and various kinds of "prompts" enable most of the students to get about 90 per cent of the answers correct as they move ahead by small steps (Green, 1962; Glaser, 1962).

The form developed by Norman Crowder and favored by some over the Skinnerian-type program, follows the pattern of the multiple-choice test, e.g.,

The largest element in the string choir is the
(1) violin (2) tuba (3) bass drum (4) string bass

In this form the student only has to recognize the right term, the steps are usually longer, and arrangements called "branching" are more easily

made for those who know or do not know certain sections to skip parts or go over additional frames.

From the point of view of research, programming is of tremendous significance since now for the first time it is possible to subject instruction to something approaching laboratory control, and it is of equal significance practically, because now for the first time it is really possible to individualize instruction. This is done by permitting students to proceed at their own rate, by branching, and by providing them with programs adapted to their individual interests, abilities, aptitudes, and needs. Programming is slow and difficult work and therefore expensive, and not all programs are good ones. But the possibilities are endless, and computer-based experimental models are already in operation.

New Designs for Learning. But even now, with other innovations such as team teaching and flexible school buildings, including different-sized rooms, education does not have to follow old patterns. The traditional methods of marking, grading, testing, and promoting can be consigned to a bygone era. An instructional materials center, individual carrels, small-group rooms, and subject-matter laboratories can replace "the classroom." Judgments of students' competence can be based on proficiency instead of the number of weeks or years they have sat in schoolrooms. The most important educational task of the immediate future is to find out what kinds of instruction can best be provided and by which media. As a possibility, if students can proceed at their own rate on the programs, those who have arrived at the end, or beginning, of certain units can be brought together for discussions, projects, or further orientation. The engineering task of making needed adjustments is a long one, and no one best solution may be expected, but educational psychologists will have a large part of the responsibility.

Technology does not necessarily imply machines, but rather a weaving together of materials into a patterned whole, the creation of a system with interrelated subsystems (cf. textile, architect). We speak of the nervous system, a railroad system, and a school system. Man-made systems (Deterline, 1962) can be modified so that they are more effective in doing what they are supposed to do. In education, different designs (Gagné, 1962) have been proposed and are being tried out to make the instructional procedures more effective

in promoting learning. All are ways of manipulating the environment, the world of the learner which it is the responsibility of staff experts and instructional personnel to control in order that the students may learn what they are expected to learn, and that the educational objectives (Mager, 1961; Bloom, 1956), both narrow and broad, may be attained. Now let us examine into what the staff members, teachers and others, are expected to do.

THE OBSERVER—THE TEACHING-LEARNING PROCESS

OBSERVING IS A PROFESSIONAL SKILL

Observing is a primary task of professional people, not merely looking at and listening, but noting carefully and exactly the nature and structure of the data with which they deal, and any changes in it that suggest order and regularity or reveal irregularities that may call for action. Various instruments have been devised to aid in observation, particularly in the natural sciences—such as the telescope, microscope, x-ray, and others—to record and measure what often cannot be directly observed, e.g., the camera with special film, the spectroscope, and the barometer. A medical examination is a systematic observation process to explore the conditions that call for treatment. Patients are sometimes hospitalized to be “under observation.”

In the case of the behavior of organisms, some observations, like those of the physician, have a fair degree of stability. The condition can be expected to remain much the same for the usual “24 or 48 hours,” or for a few weeks or even years. Such are the data that are tested by psychologists, as reported earlier. Others change from moment to moment. The environment and the organism are in a constant state of interaction and flux, and as in some sports, timing is often of the essence. If teaching is to be effective, a teacher must be a skillful observer and constantly aware of what is going on, and must control the environment accordingly.

The Teacher as Observer. Not only must teachers be careful observers, but so also must other school personnel—supervisors, curriculum experts, and guidance workers. So must the educational psychologist, and also the learner himself. They

must be able to identify the patterns of student behavior in the many forms they take. A teacher as observer must know their structure and the nature of the relationships between their components much as a chemist knows the molecular structure of the compounds on his laboratory shelves.

A teacher as observer must perceive the responses of the learner and interpret them on the basis of an adequate conceptual system. He must be able to see such things as anxiety and attention-getting in relation to his knowledge of childhood and adolescence, and of later ages too if he has any contact with them. And he must see them as good or poor responses to the objects, people, and symbols in the environment which constitutes the subject matter being learned.

To do this, he must obviously know and understand the subject matter, the selection from the environment he has under his control, and also keep an eye on the rest of the environment including the other students in the class, while he evaluates his own behavior and the effects it has on the responses of the learners. Such effects constitute the feedback which enables him to continue to adapt the instruction to their needs.

A classroom teacher also observes the behavior of the class as a whole. This is a difficult process since rarely are all students doing the same thing. For example, all but one may be attentive, and he may have fallen asleep, or a small-sized rebellion may be quietly in the making. In the case of demonstration lectures, whether or not on TV, student responses beyond signs of attention or inattention are not expected, while in discussion groups and project activities, in the laboratory, and in games and ensembles they are more frequent and more easily evaluated. Class behavior as such is difficult to describe. There is no generally accepted taxonomy, but with technological developments one may eventually be worked out.

The Learner as Observer. The students themselves are likely to be keen observers and harsh critics of teaching, although their skills along these lines are not always recognized. College students found no difficulty in observing and rating their teachers, even on the latter's ability to observe them, as is indicated by ratings on the following points (Isaacson *et al.*, 1963): “Put materials across in an interesting way . . . Explained things clearly and concisely . . . Skillful in observing

student reactions . . . Changed approach to meet new situations . . . Tried to increase interest of class in subject . . . Made clear how each topic fitted into the course . . . Anticipated difficulties before they arose . . . Was aware when students failed to keep up . . . Invited criticism of his acts . . . Told students when they had done a good job . . . Complimented students in front of others . . . Criticized poor work . . . Was sensitive to students' desire to ask questions." And the first seven of these had a factor loading of above .50 on evaluations of skill and student rapport.

One could wish that students were as adept in observing the fine points and relationships in the subject matter they are supposed to be learning, and which it is the teacher's responsibility to point out and cue them in on. He must learn what to look for and see what is important when the teacher is not there to prompt him if he is to be able to do what he is supposed to learn to do. For motor skills, one can often shift over from visual and auditory cues, things to look and listen for, to kinesthetic cues. After a time a learner can tell by the feel whether a stroke is correct or not and use this information as a part of the feedback so that the response is confirmed or reinforced if it is good, and corrected if it is not.

Cues in symbolic learning are given considerable attention in school, but often not enough. Words, numbers, and signs that signal different meanings must be differentiated and identified as part of the process of perceptual and conceptual learning. And social stimuli, those coming from people, are also important. They may also be a distraction, as we have noted. Or a student when reciting may listen or look for cues in the form of prompts from the students around him or from the teacher's facial expression. Much more attention needs to be given by the learner to social cues for improving social behavior, and particularly to the feedback from his own responses. If these are inept or not rightly understood, he is likely not to recognize the fact, but only note the displeased behavior of others which he is likely to "take personally," not realizing that he has presented the stimuli which produce the responses he does not like.

The Educational Psychologist as Observer. Like the teacher and the learner observers, the educational psychologist will also observe the parts of

the world that impinge on both, the consequent responses each makes, the feedback, and the use that is made of it. But not being a participant, he has a more objective view. With his training he should be able to notice things that the others do not—words that are not understood, that confuse, or antagonize, or that are not spoken but should be, attitudes not intended to be revealed, explanations that would be expected to clarify but do not, directions that should be followed but are not, responses that are wrong but are not corrected, and responses that are corrected but are still wrong. He may have one or two purposes in making these observations. One is to help students and teachers to deal more effectively with learning situations, and the other is to formulate hypotheses for research.

In the arts and in physical education the mistakes of the learner are objectively evident to anyone who knows the field. But with group instruction mistakes are going on all around, and different mistakes. Schools have long assumed that errors are the fault of the learner and have punished him for them in various ways. But such obvious use of the projection mechanism could not last. As Skinner has pointed out, if an animal in an experimental situation does not do what the experimenter expects, it is not the animal's fault but that of the experimenter either in misjudging the animal or, which may amount to the same thing, setting the wrong task. The same should be true of the teacher-learner relationship.

The problem is to know which learner to interrupt, just when to interrupt him, which mistakes to help him to correct, and how to help him correct them. In the language laboratory the same problem arises, but the monitor can break into but one circuit at a time. In one language laboratory, tape recordings are being made of the students' errors that cause the monitor to break in, and what he says when he does so. Thus it will be possible to find out what actually goes on. Then judgments can be made as to what presumably should be done and the improvement, if any, shown. Written work that is handed in may or may not be corrected. If it is, it is often handed back too late to have any effect, and even when a teacher "goes over the mistakes in class," there is no assurance that the students will get the point of the correction, or that they will not make the same mistake again at the very next opportunity.

THE MONITORING FUNCTION

From the language laboratory the term *monitoring* may be borrowed to designate this most crucial but often neglected educational task, whether performed by teacher, supervisor, or psychologist. It is the task of observing the learner's performance, selecting a part to be corrected, making the correction, and following through to see that the correct behavior is learned.

As things now stand, monitoring in this sense is done in different ways and with different degrees of effectiveness:

1. Continuously, when appropriate, in the tutoring situation.
2. Interrupting one learner at a time while the rest are practicing.
3. Calling on one student at a time and using his responses as an example to explain and demonstrate the correct response to him and to the others in the class.
4. Writing comments on assigned written work—problems, workbooks, essays, themes, term papers, examinations.

Monitoring occupies a key position in teaching. If correct responses were made at the start and remembered, and if stimulus and response generalization were not necessary, there would be no need for monitoring. But since these conditions do not prevail, continuing direction is necessary. For different kinds of subject matter there are no doubt precise ways of shaping behavior lying between punishment for mistakes and reinforcement of the correct responses.

THE TEACHING FUNCTION

Psychologically, the total teaching function demands certain competencies for which people need to be trained. At present, some of those whose work it is to prepare teachers seem to accept certain false assumptions: (1) That "teacher education," as they like to call it, is the thing, whereas both education and training are necessary. (2) That all students capable of performing some of the necessary teaching functions should be certified to do the others too. Anyone who has visited a few schools has been able to observe the consequences of accepting these assumptions. A further division of labor would seem in order, one in which a teacher will be expected to perform only those functions in which he is competent. A third

false assumption is (3) that roughly the same amount of professional education and training, as measured by credit hours, is necessary for all. Here, as in other aspects of the professional program, proficiency rather than sitting time should be the criterion.

Prediction. On the basis of their professional knowledge, the learner's record, and his observed responses, teachers should be able to predict the kind of educational environment from which he would profit most. This includes texts, readings, assignments, level of instruction, questions, and co-curricular activities. For such judgments, any one teacher can draw on the information in the learner's records, or any other that staff specialists can supply. It seems like quite an undertaking, and it is, but it is not always recognized as such. As things now stand, efforts are made to fit the child into the school program, though the fit is far from perfect, but more effort is needed to fit the program to the child.

Control. A teacher is expected to control a learner's environment so that it will provide the components predicted as needed. Such control is illustrated in psychological research, but with a difference. The laboratory animal is usually placed in his apparatus and then left alone to see what he will do. In education this is not enough. Continuing instruction is needed. Instruction includes the following imperatives:

(1) *Tell*, lecture, explain. Familiar in college classrooms and on television, and also at public meetings. There may be questions from the floor but not necessarily. An efficient way to convey information, but there is little knowledge of what becomes of it after it is delivered. Students are expected to pay attention and perhaps take notes.

(2) *Demonstrate*, show how, illustrate. May accompany (1), particularly in science instruction, and through audiovisual devices or play-back apparatus. The student sees or hears what is being talked about or sees himself try or someone else do what he is expected to learn to do. A very helpful aid to understanding by the learner, but the doing may require more. Students are expected to attend, watch, and listen.

(3) *Lead*, coach, direct. Invaluable in discussions and projects, with whatever degree of democratic or autocratic control is appropriate under the circumstances. Included would be coaching in team sports and directing choral and orchestral

groups. Students are expected to participate, as directed or creatively.

(4) *Drill, practice.* Repeated trials either to improve the response or to maintain it. Published materials, programmed or other, can both tell and drill. The student is expected to repeat. Requires reward or reinforcement for effective results.

(5) *Assign,* see to it that through suggestion or direction students read or practice appropriately.

Evaluation. Through informal and standardized achievement tests and through observing (watching or listening to) student performance, the degree of correctness is noted as are the errors. This point and the following constitute the monitoring function described above.

Correction. The instructor scores papers, corrects mistakes and hands papers back, explains, and shows students how to do correctly whatever they are supposed to do. This last point, which is most crucial, is likely to be overlooked.

Reinforcement. Contingencies of reinforcement have not been worked out for human subjects as they have for pigeons, but at least one condition seems to be necessary for both, *i.e.*, that reinforcement should be provided promptly either by the teacher or by the feedback from the response. Learners can do their own reinforcing, what Thorndike called the confirming "OK," or "yes" reaction—the assurance they have that the response is correct as, for example, in sports, their success, or when reading, their understanding of the meaning of what is read.

RESPONSES—TERMINAL BEHAVIOR

Just as the proof of the pudding is in the eating, so the proof of an educational system is in the responses of the learners, the output or terminal behavior, what they do and can do as a consequence. The Western nations and certain others can well take pride in what has been accomplished in this respect, but what has been done is not good enough. There is still too much illiteracy about, too much stupid behavior and irrational thinking, too much delinquency and crime, too much maladjustment and unhappiness.

CRITERIA OF RIGHT RESPONSES

What are the criteria by which terminal behavior may be judged? In the form of educational

objectives these have been stated in many ways. The following list is psychologically based.

(1) *Learner Satisfaction*, either as mediating or prerequisite to other behavior goals or responses that are satisfying in themselves—esthetic enjoyment, fun, happiness, in general what psychologists have referred to as responses that reduce tension.

(2) *Social Demand*, directly or indirectly, occupational knowledge and skills, behavior not injurious to others, that makes communication possible and is in harmony with the folkways and mores whether or not it seems entirely rational from other points of view.

(3) *Agreement*, particularly knowledge taught should satisfy the requirement of agreement with known truth or fact. Arithmetic and languages are among the areas where this criterion is valid. Where there are differences in informed opinion, as in politics or religion, it is not.

(4) *Novelty*, avoidance of the humdrum, the trite and the dated. Different values have been ascribed to originality in different cultures. In the United States inventiveness and ingenuity have been highly prized, but not always in schools, although at the present time what is called creativity is receiving considerable attention.

RESPONSES AND SCHOOL LEARNING

Four categories of behavior which in a sense constitute more immediate goals than the criteria listed above are found to a greater or lesser extent in all subjects of the curriculum.

Perceptual-motor Skills. The development of motor skill is required not only in physical education and sports but also in language pronunciation, music and other arts, and shop and secretarial work. While the schools and colleges produce excellent athletic teams and musical ensembles, they turn out thousands of students who are dubs at sports and who are musically incompetent. One wonders if more adequate instruction would not make a difference. The teaching of motor skills is similar to teaching in any other area, with particular emphasis attached to the monitoring function. But time spent in learning is even less appropriate as a criterion of proficiency than it is for most other subjects. And strangely enough less dependence is placed on it not only in physical education but in the arts where objective measures

of skill are lacking. The procedures for each skill need the attention which educational psychologists can give, and the possibilities of supplementing instruction with film and tape are not fully realized.

Affective Responses. Opinions differ as to the place of enjoyment in education. In this country, esthetic values were hardly to be discerned until the influence of the progressive education movement began to make itself felt. Although on the European continent the Renaissance brought a high regard for music, painting, and the other arts, they were largely matters of royal patronage or private or family concern, with little academic interest in them. English literature has been taught primarily as a discipline rather than as a fine art, and for the rest of the curriculum, the guiding principle in some quarters seems to be to find out what the students don't like and give them plenty of it; and if they like a subject now, to teach it so they won't. Disciplinarians shivered at attempts to water-down the curriculum. But difficulty, if not too great, may serve as a challenge and so enhance enjoyment. Ways of teaching for the satisfaction to be found in learning are still to be worked out, probably along the lines of interest, need, and competence (in relation to expectations), with freedom to explore and opportunities to create.

Social-behavior Skills. Participant behavior might be the name given to social, interpersonal responses. No standard school subjects help the pupil to relate to the persons in his groups and serve to maintain his personal integrity though exploratory efforts have been made under the head of social studies, home and family living, and the like. The school program as a whole is expected to have some influence along with other social institutions. On the other hand, some conservatives hold that the school's responsibility is for what children know, not what they are. Yet through the ages punishments have been meted out for those who are considered to have failed in this respect. Psychologists have studied the more aberrant cases, and efforts have been made to keep things from getting worse. Heavily financed mental health research projects are under way at this writing to explore more effective ways of dealing with problems of instruction in social adjustment, good citizenship, and character building, as it is variously called.

Cognitive Activity. Schools have traditionally given the greatest amount of time and attention to symbolic learning: to cultivating the intellect, to transmitting the cultural heritage, to knowledge and understanding. The rational thought processes are needed in any subject matter, most continuously and exclusively, perhaps, in mathematics and science. Percept and concept formation have already been discussed; thinking and problem solving will be considered after a word about conditioning.

PROCESSES

Classical Conditioning. In a new situation (in response to a new stimulus) one can learn to do what he has already done before in some other situation. If a child has learned to say "kitty" when he sees one, he can learn to say it when he sees a picture of one, or the printed word *kitty*. This is what occurs in what has come to be called classical conditioning, demonstrated on the native salivary reflex by Pavlov, and on voluntary behavior (called associative shifting) by Thorndike. Successive presentations of the two stimuli together (Pavlov's food and bell) do the trick, though repetition of the ineffective (conditional) stimulus alone results in its gradual extinguishing if the association has not been well-established.

Classical conditioning is the basic process in many educational situations, as in learning a foreign language vocabulary when, by indirect methods the unconditioned stimulus is the native word, and by direct methods when the object or referent is. Percepts or concepts are formed in this way, *i.e.*, the recognition of objects, symbols and persons.

Instrumental Conditioning. Also, one can learn to do what he has never done before, a process formerly referred to as trial-and-error learning, or trial and accidental success, and now called instrumental learning or instrumental conditioning because the learner manipulates some part of the environment as an instrument or means, like the latch on a puzzle box. In both, a series of trials (frequency, repetition) is necessary, and in both, reinforcement. In classical conditioning, successive deprivations of the original, effective (unconditioned) stimulus result in vanishing or inhibition of the response. In instrumental conditioning suc-

cessive deprivations of the reward or reinforcement (food pellet in animal studies) have a similar effect. However, by no means do all responses have to be rewarded, as the experiments on contingencies of reinforcement have shown.

In maze and puzzle-box experiments the animal is usually rewarded if he makes one kind of response and punished sometimes by electric shock if he does not. It is up to him. What he does is supposed to reveal the truth about behavior. This might be called the heuristic approach, but as we have seen, it is too costly to apply for educating human beings.

Progressive Approximation. When the learner cannot make the right response, as in athletic sports and other perceptual-motor skills, instruction must be provided through the controlled environment to bring about improvement. As successive trials are more and more nearly correct, and as they are reinforced either directly or indirectly and supplemented by the monitoring procedure, the behavior is gradually *shaped* to conform more nearly to the prescribed model. Instruction continues to be modified accordingly. The closer approximations and the correct responses are reinforced, and the learner moves on to more complex coordinations. The same process may be noted in other kinds of learning including the symbolic. Since learners in any one class do not improve at the same rate, in a short time they will be found scattered along a whole range at different points, and efforts to keep them together are ineffectual and even detrimental. As has been noted, the solution is only to be found in individualizing instruction. But a one-to-one teacher-pupil ratio is expensive and can only be provided for those whose parents can afford private lessons.

The new instructional devices, however, provide a way out since a series of needed facts and skills to be acquired can be prepared for him beforehand, and the learner can proceed at his own rate. Possibilities of changing the direction as a consequence of the feedback obtained are being explored. Thus pacing, the continuous adaptation of instructional materials to progress in pupil growth and development, can be more adequately handled than at present, still giving opportunities for self-selection. And shaping can take place without forcing the brighter students to wait impatiently on the sidelines for the next stage, or the slower,

because the pace was too fast, to wait for remedial instruction.

RETENTION AND USE

The process of forgetting, as charted by Ebbinghaus and his successors is a rapid one, tapering off gradually with time. Whether because of fading or inhibitions, and whatever its electrochemical base, it is an all too familiar phenomenon. It has not yet been successfully handled educationally in spite of the fact that it is uneconomical from all points of view to spend time and money teaching people what they will soon forget, especially if they make no use of it in the meantime.

Conditions. What is retained, or what is subject to retrieval, as the computer language has it, is dependent in part on the way it was originally learned, and in part on what occurs later. We know most of the conditions of learning and forgetting: (1) *set* to learn and remember, (2) *intensity* of the learning experience, though emotional factors are difficult to control, (3) *recency* of the learning experience, (4) *frequency* of repetitions in order both to perfect and to retain, (5) *reinforcement* of successfully recalled responses, and (6) *organization* of the material to be learned; items in patterns are more readily learned than discrete items to be memorized by rote. But any superiority of the whole over the part method of memorizing depends on the nature of the whole and of the parts.

Schools are most reasonable in their requirements for retention as evidenced by the use of the marking system. Amount retained is usually what is measured on tests but there is little insistence about it. Those who remember most get the higher marks, and those who remember less get lower marks, but all move along together anyway. No great effort is expended to see that the more important things are remembered. Thus students pass along from year to year not knowing different things they need for later courses, and knowing many things that are not so.

The situation is here overstated to point up some of the opportunities of educational psychologists. People do recall much that they have learned, they can look up what they have forgotten when they need it. And actually, beyond a few fundamental matters, nobody really knows what students will need in the days ahead. But research,

both basic and applied, is needed before this and other problems indicated in this chapter will be adequately dealt with.

Generalization: Stimulus, Response. If one has been shown a certain three-lobed leaf and told that it is *sassafras*, he would probably not identify correctly one- and two-lobed samples from the same tree. As was pointed out in connection with the discussion of percept and concept formation, objects and situations vary. *Stimulus generalization* is the process of recognizing which variations do make a difference and responding accordingly. But it also implies the ability to note and recognize other variations which may be obvious but which are not significant and do not make a difference. Judgments about whether certain differences make a difference, that is, whether a stimulus may or may not be generalized to include certain variations, derive from a knowledge of the facts and their inter-relationships, from experience with the situations being considered. If one does not know, the situation becomes a problem, calling for problem-solving procedures. Cues become clues in all manner of situations including identifying trees or birds, realizing the climate of a social gathering, or spotting the presence or absence of such elements as letters, words, sounds, inflections, and the like in verbal and numerical statements.

Response generalization is the process of varying the successive responses made to the same or similar stimuli. It calls for a certain flexibility of behavior in recurrent situations that make possible improved responses or the discovery of solutions. But such variations of behavior can be erroneous. Language pronunciation presents interesting illustrations. The German *U*, *Ue*, and *ü* are similar but unlike stimuli. The first is sounded much as in English, but one cannot generalize to the other two. Their pronunciation is different from the first, but in spite of their differences in appearance they are pronounced in the same way. It is a new sound for English speakers, and efforts to make the sound will vary, but most of them will not be correct. Good instruction, however, will shape the response with successive approximations approaching the correct pronunciation.

Thinking. A discussion of retention does not often subsume thinking and problem solving. But no thinking can go on without memory data, so

we are again faced with the interesting question of what becomes of what has been learned.

It is generally agreed that one of the most important objectives of schooling is somehow to teach people to think. This is a larger order than many realize, because there is more than one type of thought process. Convergent thinking—the quest for a single right solution—has been so named to distinguish it from divergent thinking, where novelty, originality, and sometimes aesthetic creativity are sought (Guilford, 1959). Educational psychologists are gradually closing in on the teaching problem. Philosophers have elaborated the processes of inference in inductive reasoning (generalizing from particulars) and deductive reasoning (concluding via the syllogism concerning the individual case). Logicians have pointed up the many fallacies including such common ones as the *post hoc ergo propter hoc*, by which temporal sequence is misinterpreted as causality, or the either-or fallacy (e.g., phonics versus the look-say method in teaching beginning reading). Freud's delineation of irrationality in the unconscious thought processes has helped, as has the clarification of percept and concept formation and their dependence on individual experience. Gestalt psychologists and others have emphasized the importance of insight and understanding, a knowledge of structure, familiarity with the ingredients of a field of knowledge and their static and dynamic inter-relationships. Experimentalists have demonstrated the effects of set, as a consequence of which a person may attack a new problem in the wrong way because it is superficially similar to those he has solved before in that way. Also it has been shown that persons who have been trained to solve certain kinds of problems may find themselves unable to generalize their procedures and solutions adequately in a slightly different situation, that is, to transfer their learning so as to be able to solve similar problems.

Transfer. Strictly speaking, transfer refers to the effects of previous learning on later learning making the latter more, or less, efficient. In practice the term is also used to apply to the effect previous learning or experience has on performance in other situations. Interference or negative transfer occurs when the transferred response is inappropriate or incorrect. Thorndike long maintained that the amount of transfer effect (positive or

negative) depends on the identical elements (or components) in the two situations, which is probably true, but an oversimplification. Thus, satisfactory transfer may involve such matters as careful inspection to note the structure of the situation, what is given, what facts or means are available, systematically forming hypotheses and trying them out to see if they work, noting consequences and making new hypotheses and new trials accordingly. When the transfer is negative, it remains transfer, but to the wrong situation. Or there may be no transfer at all because the learner may not see the identical components in the new problem that call for the previously learned response, *i.e.*, he may see no relation between his training and the new situation. Or he may see the components or relationships but forget the response, *e.g.*, the algebra needed. Or, the response in general may be correct, but a variation in the situation may call for a response generalization that he may or may not recognize or be able to make.

Such eventualities present an interesting challenge to the educational psychologist, and some have suggested that in addition to emphasizing school subjects, so as to provide an understanding of related phenomena, mental processes should be practiced so that students may learn to do what they are expected to do in a variety of settings. This, of course, is what really occurs in learning various school subjects, but in an unsystematic and desultory sort of way. No one really knows what a student has learned to do mentally in a course in geometry, for example, or physics, or social studies. It may be that programmed learning will provide experimental data that will help in the solution of the problem of teaching students to think.

CONCLUSION

What is presented in this chapter will not make the reader an educational psychologist. But it gives an idea of the content of educational psychology, its sources, and its problems. Detailed explanations of the meaning of concepts and of instruments used are not included because they would prolong the chapter beyond any reasonable bounds, and besides, many of them are to be found in other portions of this volume. As in other professional fields, practitioners depend on research

as the source of reliable knowledge, and on training in known techniques for the improvement of their skills.

We might have stopped when this was done, but instead a number of current problems have also been discussed which call for new solutions. Since all the readers of this chapter have been through school and at least a part of the way through college, they are familiar with common educational procedures and have perhaps come to take them for granted as necessary. But in scientific work even axioms are questioned. The new educational technology is opening up new approaches, and able minds are needed to elaborate them, to do the research called for, and to design and operate the educational systems and subsystems of the future so that the educational objectives may be attained more efficiently and by more people. The challenge is a real one and the opportunities are unlimited.

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CHAPTER 17

Employment Psychology

In Western Europe and the United States before the Industrial Revolution, the owner of a factory or business performed all of the functions of management, including the hiring and training of his help. Today specialization is the rule in all but the smallest of companies, and personnel departments are set up to take care of the recruitment and hiring of employees, as well as of other functions such as recreational programs, insurance plans and the like. The typical large corporation of today has one or more trained psychologists on its staff to set up scientific hiring procedures in the interests of attracting and keeping more efficient workers. Even the smaller companies that cannot afford full-time psychologists on their staffs, because of the relatively low volume of hiring, typically employ the services of a consultant who works as needed.

THE NEED FOR EFFICIENT SELECTION OF PERSONNEL

When employees are selected carelessly, both the employer and the employee pay the costs. When an inefficient employee is hired and kept on until his inefficiency becomes painfully obvious, the employer obviously loses. The maladapted employee also suffers discouragement and unhappiness. Sooner or later this grows to the point where he will ask for a transfer or decide to quit. In the meantime he has wasted part of his life that could have been used more profitably and with greater happiness in some other job. An efficient working force brings important benefits to employer and/or employee in the following ways: by preventing excessive turnover; by preventing excessive absenteeism and tardiness; by increasing output; and by preventing accidents and spoiled work.

PREVENTING EXCESSIVE TURNOVER

When an employee proves unable or unwilling to perform the duties of his job he must be replaced. The cost of hiring and training a new worker is much greater than the general public and most employers realize. In addition to the

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fact that the employer must pay the new worker while the worker is learning the job, there are costs incurred in taking the supervisor's time away from his other duties, and there is the continuing drain due to the fact that the new worker is likely to make costly mistakes, damage equipment, or cause accidents.

It has been estimated that the cost of replacing a semi-skilled worker runs into the hundreds of dollars and that of replacing high-level technical or executive personnel runs into many thousands of dollars. Obviously it is good business for an employer to secure competent help who will be content to stay on the job or grow in value to the company so that they are ultimately promoted to better paid and more rewarding work.

PREVENTING EXCESSIVE ABSENTEEISM

Analysis of absenteeism records of a wide variety of organizations indicates that 3 per cent absenteeism—missing one day in every thirty-three working days—is a reasonable standard. When the rate is higher than this, there is usually something wrong. In most instances a high rate of absenteeism indicates that management has failed to fit the worker to the job.

INCREASING OUTPUT

Efficiency of a worker can be defined as the units of work performed per unit of time. The worker who has been carefully selected and trained for his job will typically produce more than twice as much as the worker who is poorly suited to his job. When the poorer worker gets the same or about the same hourly wage as the faster worker, the employer is quite obviously penalizing himself. Even when a piece-rate plan of payment exists, it is still to the advantage of the employer to hire only the more efficient workers, because his overhead costs (space, heat, light, etc.) and general administrative costs (supervision, bookkeeping, etc.) constitute a higher proportion of the total cost of goods manufactured in the case of the slow worker as compared to the worker whose output is greater.

PREVENTING ACCIDENTS AND SPOILAGE

Inefficient workers make more mistakes than efficient workers, thus building up heavy costs for rework, work so badly spoiled that it must be scrapped, and accidents resulting in injuries to

people and equipment. It is just good business to have efficient personnel.

In this chapter we will consider the important ways in which psychologists help management achieve better profits through effective selection of employees. It should be pointed out at this time that effective selection is not a one-way street leading only to higher profits for the employer. The properly selected employee will be happier, as well as more efficient in his work. The best man for the job usually finds that job to be the best job for him—or, at least, a fairly good one.

STEPS IN SETTING UP AN EMPLOYEE SELECTION PROGRAM

The procedure to be followed in establishing a sound selection program requires the following steps:

- (1) Establish criteria of efficiency on the job.
- (2) Analyze the job to determine what measurable abilities are required.
- (3) Select promising tests or other sources of information for trial.
- (4) Analyze each bit of information to see if it differentiates between successful and less successful workers now on the job.
- (5) Combine the bits of predictive information on the basis of how much each helps in differentiating between successful and less successful workers.
- (6) Gather the required information on newly hired personnel and place each of them on the available job.
- (7) Follow up the personnel hired to see how well the system is working.

Each of these steps will be explained in the following pages briefly but in sufficient detail to serve as a guide in building a selection program in any business or industrial organization.

This procedure can be applied to any kind of available information about the employee or applicant, whether it be personal interview, application blank, or psychological tests. The fact that the rigorous procedure outlined above is not always used is no criticism of the procedure.

CRITERIA OF JOB PERFORMANCE

A measure of success in job performance is called a criterion. Good criteria are needed in

nearly all personnel procedures and actions, including evaluation of employees for possible salary increases, promotions, etc., as well as for the validation of tests or other devices used in hiring. However, it is not always easy to arrive at dependable criteria. In fact, so serious is the problem of developing adequate criteria that it now overshadows the problem of developing tests and other predictors. These, after all, can be validated only on the basis of job success criteria.

The events of World War I taught American psychologists the *necessity* of validation. The experiences of the next two decades taught them much about the *technique* of validation. It remained for World War II to drive home to the psychologists at large the necessity of devoting much time and thought to the *basis* for validation (Jenkins, 1946).

Most criteria may be classified as either objective, based on something other than subjective judgment, or subjective, based on judgment of the employee's worth by others.

OBJECTIVE CRITERIA

Among the most common objective criteria are production records or records of the worker's other work behavior such as tardiness, absenteeism or accidents. The former consists of the number of pieces turned out per hour, day or week or, negatively, the number of rejects or the amount of scrap produced by the worker. Sometimes a combination of two or more criteria is used to arrive at a composite objective criterion. For example, in an early study of card punch machine operators the criterion used was number of cards punched adjusted for number of errors (Marcus, 1920). In a later study it was found that correcting an error made in card-punching required as much time as it would take to punch 13.75 additional cards; therefore, the total production of the operators was diminished by 13.75 for each error made (Stead and Shartle, 1940). Combinations of such criteria as gross sales, number of sales and returns are often used by department stores to provide an index of total job performance.

One investigator has pointed out that no single criterion is adequate to measure success in all six of the major areas in which employees affect company profits (Wherry, 1950). His list, which is designed to be suggestive rather than exhaustive

and which classifies a number of criteria, largely objective in form, according to the area to which they apply, is as follows:

1. Bearing on output per unit of time
 - a) Units produced
 - b) Number of sales
 - c) Items coded
 - d) Earnings on a commission basis
 - e) Words typed
2. Bearing on quality of production
 - a) Number of rejects
 - b) Cost of spoiled work
 - c) Coding or filing errors
 - d) Returned goods (sales)
 - e) Disgruntled customers (complaints)
3. Bearing on lost time
 - a) Days present
 - b) Number of tardinesses
 - c) Days sick
 - d) Visits to first aid section
 - e) Length or frequency of unauthorized rest pauses
4. Bearing on turnover
 - a) Length of service
 - b) Quits
 - c) Discharges
 - d) Transfers due to unsatisfactory performance
 - e) Transfers at request of employee
5. Bearing on training time and promotability
 - a) Training time to reach standard production
 - b) Cost of material spoiled during training
 - c) Rate of advancement
 - d) Training courses successfully completed since enrollment (number of jobs in plant for which employee is qualified)
 - e) Merit ratings (times recommended for promotion)
6. Based on employee satisfaction
 - a) Number of grievances registered
 - b) Morale survey standing
 - c) Visits to plant psychiatrist
 - d) Participation in plant athletic contests
 - e) Contributions to "suggestion system"

In general, objective criteria are more dependable than subjective ratings in evaluating job performance. They should, therefore, be examined for possible use in situations where objective criteria are available for the job in question.

SUBJECTIVE CRITERIA

Since, unfortunately, suitable objective criteria are not available in most cases, it is necessary to obtain subjective estimates of the worker's performance on the job, usually from his immediate supervisor. Such ratings may be based on a variety of factors, from actual production considered in relation to opportunity of various workers to produce, to attitude toward superiors and fellow workers.

A variety of methods of rating employees are available from which a company may choose. However, most of these may be classified as belonging to one of the four general types to be discussed below *relative*, *absolute*, *check list* and *forced choice*.

RELATIVE METHODS

In relative rating methods each person rated is compared on the basis of some trait or characteristic to every other person, all finally listed in rank order from best to worst in a particular group. Scores assigned to individuals may be compared to those assigned to any other person in the group but cannot be directly compared to those assigned to individuals in another group. The fact that groups differ in size is one reason such comparisons cannot be made. Obviously, to be first in a class of ten is not as outstanding as to be first in a class of one hundred, even though the class average be the same.

There are two basic types of relative rating methods: *order of merit* and *paired comparison*.

Order of Merit (Ranking). In this method the rater arranges those being rated in order from best to worst. This may be done for specific traits, repeating the ranking process for each trait being rated, or for overall job performance.

This technique is feasible only for small groups of employees, ten to twenty at the most. If there are more than that the supervisor finds it very hard to discriminate accurately between the workers, especially in the middle brackets. Another problem encountered in the use of this method is that, although each person is assumed to be separated from the next in rank by an equal interval, there may actually be much more difference in performance at the extremes of the scale, that is, between Number 1 and Number 2 or between Number 19 and Number 20, than there is be-

tween Number 9 and Number 10. However, the ranking system is simple to use and easy for both supervisors and employees to understand; therefore, it has been widely used in industry, often yielding high reliability.

Paired Comparison. One of the oldest procedures of evaluation, developed by psychologists about the middle of the nineteenth century, is that of paired comparison. The names of the employees are presented in pairs, and the rater is to underline in each pair the name of the worker he judges to be the more valuable employee. The number of comparisons to be made is determined according to the formula: $N(N-1)/2$, where N is the number of persons to be rated. Thus, a group of four employees would require six comparisons, which might run as follows:

Allen-Brown
Conway-Allen
Allen-Davis
Brown-Conway
Brown-Davis
Conway-Davis

The next step is to tabulate the number of times each name was marked as preferable and arrange the names in rank order on the basis of this tabulation:

Name	Tabulation	Rank
Allen	///	4 (highest)
Brown	//	3
Conway	0	1 (lowest)
Davis	/	2

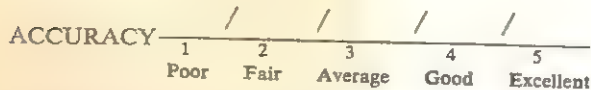
Although feasible for somewhat larger groups than the straight rank order method, this technique becomes unwieldy in groups larger than about thirty employees, because of the huge number of paired comparisons required. However, the mechanics of the method can be considerably simplified.

ABSOLUTE RATING METHODS

In absolute rating methods the judge assigns a score to each individual on the basis of how that individual compares in the trait defined to some absolute standard based on persons outside the group being evaluated at a particular time.

There are several forms of absolute rating but the two most common are the *graphic rating scale* and the *forced distribution*.

Graphic Rating Scale. Perhaps because it is easy to use, the graphic rating scale method is one of the most widely used employee evaluation techniques in industry. A list of job performance traits is drawn up and each trait is rated along a scale, usually a line marked off to show varying degrees of the trait. For example:



Often each alternative is explained more fully, in an effort to overcome the lack of a real basis for comparison which is a major weakness of this method. Thus, "Poor" might be elaborated to read, "Makes so many mistakes that his work speed is noticeably slowed down." "Excellent" might be interpreted as, "Makes almost no mistakes," etc.

Forced Distribution. The fact that any specific trait is found to be distributed in the population according to the normal curve may be utilized in improving the graphic rating scale technique. The rater is forced to spread the rated employees over a bell-shaped curve. That is, he may be required to rate approximately 10 per cent of his men as excellent (or in the top bracket, however it is designated), 20 per cent as good, 40 per cent as average, 20 per cent as fair and 10 per cent as poor. This forces the rater to compare the men with each other to a greater extent than in using the plain graphic scale and prevents him from consistently using only the middle or the higher part of the scale, as some raters tend to do. A major disadvantage of the forced distribution method is that it is not readily applicable to small groups of employees. For example, a supervisor with nine men under him, all of whom may be quite satisfactory workers, should not be expected to rate one of them arbitrarily as poor.

CHECK LIST

A method which is simple to use but can yield sound ratings if properly constructed is the check list, which contains a series of statements or phrases describing various aspects of work performance. The supervisor is to check those which he feels are characteristic of the employee being rated. These may include such items as, "Always arrives on time," "Makes very few errors," "Is untidy in work habits," "Resents constructive criticism," etc. It is usually a good plan to have the

supervisors themselves suggest the items to be used so that these will reflect the terms in which they usually think of employee performance.

Some check lists are made up on the basis of one knowledgeable person's idea of what are good and what are bad characteristics. A more effective check list, however, can be made up by employing a modification of the Thurstone method of equal appearing intervals (Richardson and Kuder, 1933).

Just how a check list of this nature is developed is described in a more recent article (Knauff, 1948). The check list was constructed for use in a validation study of a selection test for laundry press operators in which data from a number of laundries had to be collected, since an average of only eight press operators were employed in each laundry—too small a number to make validation possible in any one laundry alone. The first step in constructing the scale was to ask each of twenty-five laundry managers to prepare a list of statements, each of which described the performance of a press operator in terms of one thing the operator did which would help or hinder her own production or that of other workers around her. From approximately 600 statements collected, 197 were selected and submitted to twenty-seven laundry managers for sorting. The managers were instructed to sort the statements, each of which was reproduced on a separate card, into nine piles which represented nine points on a good-to-poor press operator continuum. The median scale value of each statement was computed on the basis of the position assigned to it by the sorting managers, as was the semi-interquartile range (Q value) of each statement. A Q value is equal to one half of the distance between the 75th and the 25th centiles. The 75th centile is a score value that separates the top fourth of the cases from the bottom three fourths. The 25th centile separates the top 75 per cent of the cases from the lower 25 per cent. Thus the more agreement among the judges as to what value to assign to a statement, the lower the Q value for that statement. After all statements with a Q value of one scale unit or more were discarded, 150 were left. From these the final scale was constructed on the basis of the median scale value of each statement, using statements with the smallest Q values when possible. Two equivalent forms of the final scale were constructed, each containing 27 items

with scale values at approximate intervals of 0.3 scale unit.

The items in each form were then placed in random order and the rater was asked to mark each statement as true or not true of the operator being rated. Each ratee was given a score obtained by computing the mean of the scale values of the statements which were checked as being true of him. Since the scale values of the statements were not shown on the check list itself, they were not known by the raters.

This type of scale has a number of advantages over graphic or linear scales. For one thing, the opinions of a large number of "experts," rather than merely the judgment of one scale constructor, can be utilized in the selection and weighting of the items used. Two equivalent forms may be constructed with comparative ease, making it possible to obtain a precise measure of the reliability of the scale. The completed forms may be scored objectively and rapidly. An important advantage from the standpoint of ensuring objectivity on the part of the raters is the fact that the exact weights of the items are not known to the raters. The weighted check list has shown satisfactory reliability and has yielded distributions of acceptable form and range in specific industrial situations and it may be used as an overall criterion measure because of the large number of aspects of job performance it can cover, yet it may be used effectively with only a few simple instructions to raters, no extensive training program being needed.

FORCED-CHOICE METHOD

This appears to be the most valuable rating method and is one that has developed from work done by psychologists in the United States Army during World War II. When it suddenly became necessary to promote a number of high-ranking officers immediately to serve as generals of the forces being mobilized, it was discovered that the officer efficiency ratings, using an absolute rating scale, which had been applied regularly and conscientiously every six months for many years, were of very little value in indicating which men were best fitted to serve in the top posts. Rather than showing which 150 men out of the 4000 ground officers were best, these reports indicated about 2000 of them as being superior and best. The rating scales which had been used, and which

compared favorably with those currently in use in industry, were numerical scales covering such traits as "leadership," "attention to duty," etc., each of which was rated on a five-point scale of superior, excellent, very satisfactory, satisfactory and unsatisfactory. Because of the importance of these efficiency reports to the officers involved, their superiors hesitated to give poor ratings; therefore, nearly every man ranked high.

In an effort to develop a more satisfactory method of measuring officer worth, various rating methods were validated against a criterion based on the consensus of fellow officers. Working in groups of 20 to 40, officers who knew each other's work and qualifications were given an alphabetical list of all names in their group, regardless of rank, and asked to select, without revealing their own identities, the most competent, the least competent, the next most competent, the next least competent, and so on until all but about five names had been designated as among the most competent or the least competent. When ratings made by the various methods were validated against this criterion, the forced choice method made by far the best showing.

Forced-choice rating items often consist of sets of four phrases or adjectives describing personal traits or job performance. In each set the rater selects the phrase which is most characteristic of the ratee and the one which is least characteristic. Each set contains two apparently favorable and two apparently unfavorable terms; however, only one favorable term and one unfavorable term is significantly related to success on the job. The ratee thus receives a plus mark or a negative mark only if the significant item is checked. Scoring of a forced-choice blank is done in the central personnel office by means of a scoring stencil which is never made available to the raters. In this way they do not know which items are significant.

A forced-choice form, once developed, can be used for a wide range of jobs, even for highly technical professional jobs, as was shown in a study of its value in measuring the performance of professional personnel, including hospital physicians, dentists, public health personnel and nurses, in the United States Public Health Service (Newman, Howell, and Harris, 1957). This investigation evaluated four sections of an Experimental Efficiency Report: a forced-choice rating form consisting of 50 tetrads adapted from items de-

veloped by the Department of the Army; a ten-point scale for rating job proficiency in the ratee's primary job function; eight ten-point scales for the evaluation of personal qualifications, and a 22-item check list developed from comments appearing in the efficiency report in use in the Public Health Service, the Officer's Progress Report. Eleven five-point rating scales of performance and a series of coded and scored narrative comments taken from the Officer's Progress Report were also available for comparison with the various sections of the Experimental Report. The criteria of performance were twenty-point graphic rating scales for the evaluation of work performance and personality, on which each ratee received a criterion score consisting of the average of the ratings given him by his work associates on each scale.

Results indicated that the forced-choice section of the Experimental Report was highly effective for evaluating performance, showing generally higher validity than the other sections studied. The highest validity coefficients occurred for hospital physicians. In general, higher validity coefficients were obtained when the criterion was work performance rather than personality. Validity coefficients based on sections of the Experimental Report did not vary consistently in accordance with grade level of the personnel evaluated. Satisfactory reliabilities were obtained for all sections of the Report. Multiple correlations indicated that in some instances, but not in all, prediction was increased by the use of more than one section of the Report. The most useful combinations tended to include the forced-choice section in combination with one of the rating scale sections, usually the one on personal qualifications. Thus it would appear that the forced-choice method is of value for the evaluation of personnel in highly complex jobs where it is often difficult to obtain adequate assessments of performance.

Although the forced-choice method has been proved valid in these and other studies and is also simple to use, it is not very widely used in industry as yet. Perhaps this is at least partly due to the time and effort, and hence the expense, involved in constructing a valid rating blank. It is often difficult for small companies to undertake the construction of a blank which will be custom-made for their particular requirements and also to validate such a blank properly, because of the small number of employees available on which to

test it. Another difficulty which may be encountered in the use of the forced-choice method is the fact that some raters may not react favorably to the use of a rating form containing descriptive statements the value of which is unknown to the raters. Others, however, actually prefer to use such a scale because it relieves them from the unpleasant task of knowingly giving low ratings to inefficient workers. Furthermore, the fact that the raters themselves play a major part in constructing the form leads them, in most cases, to regard its use favorably.

PROBLEMS IN DEVELOPING RATING SCALES

A number of problems may be encountered in developing a workable rating scale. The selection of the traits or dimensions for the scale is one of the first problems to be solved. Other problems are encountered in determining the significance of relationships between traits, formulating clear definitions, weighting the traits, and deciding how many of them to include.

Selection of Performance Traits To Be Rated. The objectives of the rating program will largely determine the kind of traits included in the scale. Each trait or characteristic selected should be defined clearly but as simply as possible. In general, items expressed in complete sentences have been found to be superior to those expressed in phrases, which, in turn, are preferable to those described by a single adjective or adverb. An effort should be made to keep the traits used as distinct from each other as possible, to avoid overlapping in what is being measured.

Number of Traits. The number of traits used on rating scales in industry varies widely. For more complex jobs such as supervisory or executive jobs the average number is higher than for simpler types of work. The specific purpose of the rating, as well as the job itself, must be considered in determining the number of items to include. One or two traits may be enough if the information is merely to be used to validate selection procedures; however, more items may be needed to provide adequate information for counseling, training, or promotional purposes. Most supervisors feel greater confidence in a rating scale that calls for the rating of a rather large number of traits. However, statistical analysis has revealed that in most cases very few traits are actually measured by a given rating scale, even though it

may contain a good many items. Thus one investigator found, in a study of a scale purporting to measure twelve traits, that only three factors—performance on the job, quality of work, and health—were operating in the judgments obtained (Tiffin, 1958).

Weighting the Traits. Since some characteristics are more important to the job than others, traits must be weighted. A given trait will receive different weights for different jobs. Personal neatness, for example, is more important for an office employee who must meet the public than for a shop worker. The statistical procedures for weighting of items are quite sophisticated and their study must be reserved for an advanced course.

ERRORS TO BE AVOIDED

Rating scales of different kinds are susceptible to different kinds of errors. Some errors in rating are common to two or more types of rating scales. Basically there are six types of errors: *leniency error*; *stringency error*; *central-tendency error*; *halo effect*; *contrast error* and *proximity error*. This state of affairs gives rise to the problem of which errors to avoid and this, in turn, depends upon how the rating scale is to be used.

Leniency Error. Most supervisors rate their employees higher than they should, especially in the case of men they know well. This tendency appears to be constant, regardless of the specific traits rated. It may be partially offset by using rating scales with only one negative descriptive term, the remainder representing various degrees of favorable description. That is, both "very poor" and "poor" would not be used but instead, "poor," "fair," "average," "good," and "very good."

Stringency Error. Some raters, having higher standards than most, give ratings which are lower than the employees deserve. This, the obverse of the leniency coin, is called the error of stringency.

Central-tendency Error. In contrast to the error of leniency or stringency is the error of central tendency, in which the rater avoids making extreme judgments and tends to place all employees being rated near the mean of the group. This error is more common in cases where the rater does not know those being rated very well. To offset this error it is advisable to adjust the strength of the descriptive adjectives so that the intermediate words or phrases are spaced farther apart.

Errors of leniency, stringency, and central tend-

ency cannot occur in relative rating procedures and are reduced in the forced-distribution method of rating.

Halo Effect. Perhaps the most frequent error of all, which virtually every judge is guilty of to some extent, both in relative and absolute rating scales, is the error which E. L. Thorndike was the first to call the halo effect (1920). This is the tendency to judge the individual being rated in terms of one's general impression of him, ranking him high in all traits if the general impression is favorable and low in all or nearly all traits if it is unfavorable. Thus the ratings of some traits are less valid than others. This error also introduces a false degree of positive correlation between traits. Although the halo effect can perhaps never be completely avoided, psychologists have learned where it is most likely to be found and can thus take steps to avoid it or hold it constant. The halo effect is most prevalent in traits which are not easily observable, not frequently discussed or not clearly defined, and also in traits involving reactions with other people and in character traits of high moral importance (Symonds, 1925).

Among the devices used to counteract the halo effect are the process of rating all ratees on one trait at a time and, as we have seen, by the use of the forced-choice technique.

Contrast Error. The tendency for a rater to rate his employees on a given trait in the opposite direction from himself is known as a contrast error (Murray, 1938). The exceedingly punctual rater is likely to see his men as less punctual than himself, while the unpunctual rater tends to regard others as more punctual than he. On the other hand, some traits, such as a very high degree of tolerance, may tend to blind the rater to the existence of the opposite trait, intolerance, in others, leading to a reversal of the contrast error.

Proximity Error. An error which was not recognized as early as the preceding ones is the tendency for sheer nearness in space or time to affect the rating of two traits (Stockford and Bissell, 1949). That is, traits listed next to each other on a rating scale will have higher intercorrelations than those located farther from each other. In fact, the average intercorrelation of adjacent traits has been found to be .66; this figure gradually decreases with more remote traits until with five or more intervening traits the average is only .46. When the same traits are rearranged in random

fashion, the new ratings show the same differences in intercorrelation of traits according to how close they are to each other on the scale. One way to counteract this tendency would be to place obviously similar traits as far apart as possible, placing dissimilar ones close together. Better still would be having the raters rate one trait at a time, separating traits by greater time intervals. ■

Minimizing Errors by Training Raters. A number of methods for offsetting or preventing rating errors have been suggested above. However, the most effective method is to train the raters themselves. Raters who know what the different errors are and where they are most likely to creep into their judgments can do much to counteract these errors themselves. Practice in rating followed by group discussion has proved to be a particularly effective method of training.

Minimizing Errors by Proper Choice of Rating Form. By far the best way of minimizing errors is through the use of the forced-choice rating form. Although a great deal of work is involved in developing such a form, its superiority in validity and reliability makes it worth the effort.

CRITERION CONTAMINATION AND DISTORTION

In some cases criteria are carefully developed but used carelessly in the validation of selection programs. In other cases the criterion is by its very nature subject to distortion.

Contamination Through Knowledge of Predictors. The use of predictor data in preparing records which are later used as criteria is a common source of criterion contamination. In some training programs, instructors who have a copy of the psychological test scores made by their trainees will use these scores, consciously or unconsciously, in deciding upon the final course grades. Grades arrived at in this manner, used as a criterion, will show a spuriously high relationship between test scores and final grades. In similar fashion, merit ratings in industry may also be useless for validating tests in cases where the supervisors making the ratings know the test scores, having used them for counseling purposes. To prevent this form of criterion contamination it is wise to obtain criterion ratings before any predictor data are released.

A more subtle form of contamination may occur when knowledge of predictor data affects treatment of workers. That is, those known to have made promising predictor scores may be

given the most favorable working conditions or may receive extra attention from their supervisors, which enables them to develop into even better workers than they might have if their predictor scores had not been known. This state of affairs would contaminate any work production criterion used to validate the particular predictor tests used in the selection of workers.

Distortion Through Artificial Production Limitations. As pointed out above, objective criteria, where available, are usually best. However, they are subject to certain dangers of distortion which should be guarded against. Even the apparently simple criterion of production records may be distorted by artificial limitations imposed by the equipment used. If a machine can produce only 1000 units a day, the man who is capable of turning out 1200 or more units has no opportunity to show his superiority over the worker who can produce no more than 1000 units a day. The typist who must use a manual typewriter cannot be expected to turn out as much work per hour as the one who is allowed to use an electric machine. Comparisons between workers' records, therefore, should be made only after careful consideration of such factors as these. A similar source of distortion exists in sales jobs, as in department stores, for example, where certain counters are more favorably situated to attract customers than others.

Distortion Through Selective Task Assignment. Sometimes the best operators are given the most difficult tasks, as, for example, when assigned to a "balky" machine. In this situation it can happen that the objective output of the best worker is lower than that of a worker inferior to him in ability. This serves to lower the correlation between predictor scores and the criterion.

Contamination by Experience. Another common source of criterion contamination occurs where jobs require a substantial training period before top proficiency is attained. Records of experienced workers should not be combined with those of relatively inexperienced workers in establishing a criterion. Likewise, number of accidents is a criterion which may be contaminated by experience, since it has been shown that experienced workers have fewer accidents than do inexperienced ones. Of course, very seldom is a work group homogeneous as to experience; minor differences can be corrected by statistical procedures to some extent, however.

JOB ANALYSIS

Referring back to page 287 the reader will notice that the second important step in setting up a scientific selection program is to perform a job analysis to determine what is required of the successful employee on the job in question. Let us examine some of the procedures involved in this sort of job analysis.

JOB DEMANDS MUST BE MEASURABLE

Unlike job analysis techniques the reader might have studied in other courses, the primary objective is to find traits that can be measured with a reasonable degree of reliability at a reasonable cost. The industrial psychologist is thoroughly acquainted with available measuring devices, so all he needs to do is study the job and select the most promising tests or other measuring devices to be tried out.

SOURCES OF INFORMATION IN JOB ANALYSIS

The industrial psychologist uses five sources of information in determining the measurable traits required to perform the job: observation of workers; interviews with workers; interviews with supervisors; study of materials and machines; and forms and documents.

Observation of Workers. This is probably the most commonly used method of gaining job and worker information. When operations are too rapid to permit accurate personal observation and recording, photographic methods may be employed.

Interviews. This method has several serious limitations. The entire procedure is useless unless rapport can be established with the worker. This is often hard to accomplish, since workers often suspect some sort of speed-up is being contemplated by management. Even in cases where good rapport exists, interviews may be useless, for example, in cases where subjects cannot express themselves well in words. For these reasons and because of his greater knowledge of the job, an interview with a supervisor is more valuable.

Materials and Machines. Knowledge of the tools, equipment, machines and materials used in a job is a useful source of information in job analysis, serving to check the information obtained by other means. In some cases the employee's

knowledge of material and tools furnishes all the information needed.

Forms and Documents. Published manuals, charts, bulletins, etc., are often of great value in determining measurable job demands. In many jobs some of the duties and qualifications are set down by executive order and might not be observable on the job.

THE CRITICAL-INCIDENT TECHNIQUE

This technique is actually a variation of the interview and questionnaire. A good definition of a critical incident is "something an employee does or doesn't do that results in success or failure on a particular part of a job" (Flanagan, 1955). For example, a secretary may be told to mail a letter, but two days later it is found on her desk. The statement that she is careless or undependable is an expression of opinion. Her failure to mail the letter is a fact. A critical incident is such a fact—an incident of *behavior* that was critical to success or failure on a specific task. To collect such incidents the industrial psychologist interviews workers, supervisors, subordinates, and work associates. A typical question for use in an interview with a supervisor might be, "Who was the last person you formally reprimanded (or commended), and what did he do to cause you to take such action?" Interviewing is particularly important at first, in order to focus attention on the kinds of behavioral descriptions desired. Later, when personnel is familiar with the sort of information needed, critical incidents may be collected by means of questionnaires.

A typical critical-incident questionnaire form is that used by Minnesota Mining and Manufacturing to obtain data on salesmen. This form contains the following instructions and questions (Kirchner and Dunnette, 1957).

Critical Incident Record Form

Think back over a period of time (six months or so) long enough for you to have observed the activities of all your salesmen. Focus your attention on any one thing that one of your salesmen may have done which made you think of him as an outstanding *good* or *very effective* salesman. In other words, think of a *critical incident* which has added materially to the overall success of your sales group. *Please do not record any names of persons involved in the following incident.*

What were the general circumstances leading up to this incident?

Tell exactly what your salesman did that was so *effective* at that time.

How did this particular incident contribute to the overall effectiveness of your sales group?

When did this incident happen?

How long has this salesman been on his present territory?

How long has this salesman been with 3M?

The focus of the critical-incident technique is always on behavior—good and bad, effective and ineffective. Usually the incidents collected for a particular job are grouped into categories representing the critical requirements of that job, such as planning ahead, persisting on tough accounts, and following up. These critical requirements are based on actual job behavior over a period of time and thus provide a meaningful basis for the development of measures of job performance, as well as for selection and training programs.

USE OF DICTIONARY OF OCCUPATIONAL TITLES

This comprehensive work, first published in 1939 and then revised and extended to two volumes in 1949, was prepared by the staff of the United States Employment Service primarily for the use of public employment offices. It is published by the United States Government Printing Office. The information from which each definition was written was secured from two sources. The first of these was direct observation of jobs, and the second was information gathered through other sources such as trade associations and labor unions. It should be recognized that no two jobs are exactly the same in different parts of the country or in different companies in the same community. Thus there is no substitute for careful job analysis, as described earlier in this section, but study of the *Dictionary of Occupational Titles* is still a valuable first step.

SELECTING TESTS AND OTHER MEASURES FOR TRYOUT

The reader will recall that the third step outlined on page 287 involves the selection of tests or other items of information to be analyzed against the criterion. In doing this the personnel psychologist uses many sources of information.

Among these, the one most useful is the *Sixth Mental Measurements Yearbook*, which describes and reviews critically all of the better known psychological tests (Buros, 1964). This important work is used in connection with another publication called *Tests in Print* (Buros, 1961). This smaller publication serves as a sort of index to the larger *Mental Measurements Yearbook*.

Among the various types of measuring devices, the ones whose use is growing most rapidly are *psychological tests* and the *biographical data* or weighted application blank. The personal interview is still widely used, but a mounting volume of evidence indicates that it is a relatively ineffectual procedure. Other time-honored procedures which are on the way out will be briefly considered at the end of this section.

PSYCHOLOGICAL TESTS

Although the use of psychological tests has been subjected to a great deal of criticism by popular journalists and other non-psychologists, their use in industry has been increasing steadily during the last twenty years. This growth in the use of psychological tests was given its impetus by the outstandingly good results obtained with testing of military personnel during World War II—a growth which has been stimulated and maintained by the equally good results that have been obtained in their use in industry. Industrial use of tests has been especially great in recent years in the selection of executives (Ward, 1960). A survey showed that 99 per cent of executives under age thirty had taken psychological tests.

In a recent survey of hiring practices, 2771 questionnaires were sent to personnel executives who appeared in the Directory of the American Society for Personnel Administrators (Sperber, 1964). A tabulation made on the basis of the first 790 replies showed that, in 1958, 59 per cent of the companies were using psychological tests as a part of their employment procedure. By 1963 this proportion had grown to 84 per cent. Interestingly enough, the larger companies (employing over 1600 persons) are more likely to make use of psychological tests, as was shown by the fact that 73 per cent of these companies were using them in 1958 and during the year 1963, 89 per

cent of the larger companies were using psychological tests.

ARMY AIR CORPS EXPERIENCE

One of the most outstanding testing programs of all time was that of the United States Army Air Corps in World War II. Over a period of four years approximately 1,500,000 cadets were tested, at an average cost per man of \$5.00. Billions of dollars in training costs were saved by the selection of men who were well-suited for their jobs and could be made ready for active service in a minimum of time. Before the testing program was initiated, one failure in training was admitted to every pilot who successfully earned his wings. Later in the program this ratio was reduced to one in ten by the use of tests and other techniques developed by psychologists.

In the School of Engineering at Washington University it was found that one third of those who failed on a battery of aptitude tests did not finish school when given an opportunity. In the same city of St. Louis the police department found that tests rejected 40 per cent of those who would not complete their training and probationary period.

It should be pointed out at this time that not all testing programs have been reported as successful and that there have been a number of instances in which tests have added little to the accuracy of prediction obtainable from other sources. In general, however, tests have proven to be as good or better than any other single source of information upon which selection decisions might be based. Obtained validities have varied widely among jobs and among tests. A test which has high validity for one job may have little or no validity for another. There is, therefore, no such thing as "a valid test." Instead, we must ask of the test, valid for what, or, what tests are valid for a particular job. The only way to find out for sure whether or not a test is valid for a particular job in a particular company is to try it out and determine the degree to which the scores from various tests, properly combined, predict later success.

Before taking up the discussion of how to validate tests and select test batteries, it is well to get a notion of the various kinds of psychological tests available. The most common way of classifying

tests is in terms of the characteristics measured. These are basically of three kinds—ability or aptitude, proficiency, and motivation.

ABILITY TESTS

Ability tests break down further into tests of so-called "general intelligence" and tests of unique abilities or factors. Generally speaking, aptitude tests measure ability to learn and predict the level of performance that will be attained after training.

General-intelligence Tests. Although the general intelligence test is pretty much outmoded and should be replaced by tests of specific abilities, it still continues to be used because of its historic tradition. The first widespread use of general-intelligence tests in the selection and classification of personnel occurred in World War I, where some two and one-half million young men were tested and assigned to appropriate military duties on the basis of the results. During World War II some thirteen million military personnel were tested. By this time, however, the concept of special abilities had been demonstrated in the laboratory and its great practical value was proved by the accuracy of predictions of job success such as those made by the psychologists of the Army Air Corps.

Two of the more common of the old type of general-mental-ability tests are the *Otis Quick Scoring Test* and the *Wonderlic Personnel Test*. The Wonderlic Personnel Test was developed along the lines of its predecessor, the Otis Test, and the Otis itself was developed through modification of the famous Army Alpha of World War I. Tests such as the Army Alpha and the Otis attempt to measure a general capacity of the individual to learn from experience. This definition is based on the assumption that, given equal opportunities, more intelligent people will learn more than less intelligent ones. Therefore, it is only necessary to measure how much people have learned in those areas to which everybody is exposed, and this then becomes a measure of their ability to learn. The problem, however, is to construct tests based upon experience common to all persons (country versus city children, native versus foreign born, Negro versus white, etc.). Assuming, however, that the test constructor has succeeded reasonably well in developing tests of this sort, it is easy to see why such tests should work in selecting employees for most jobs requiring

ing a continued learning process of the individuals who are to be most successful. Work methods change with time, as do materials and machines, and there is no such thing as standing still in our modern industry.

Tests of Unique abilities or Factors. Although the old World War I type of general intelligence test continues in use and continues to be of some value, there are modern testing devices that provide the personnel psychologist with much sharper tools. These are the tests of unique abilities, derived through the use of an advanced statistical technique called *factor analysis*. This is an analysis of the intercorrelations among tests; it is based on the assumption that a positive correlation between two tests means they are measuring the same ability or abilities and that, by the same token, a zero correlation means that the tests are measuring different abilities.

As early as 1904, Charles Spearman proposed a two-factor theory of intelligence (Spearman, 1904). Spearman had found that most of the mental tests then available correlated positively but that the correlations were not as high as their reliability would have made possible if they were all measuring the same thing. He concluded that each test must be measuring two factors—a *general* factor, which he defined as *general intelligence*, and a *specific* factor, unique to each test.

More refined statistical techniques have shown that the picture is considerably more complicated than this. It is now recognized that in most cases where tests correlate positively with each other, they share not one general factor but several factors, each contributing its share to the correlation. The more factors two tests have in common, the higher their correlation. Thus psychologists today generally accept a *multiple factor theory*.

The real pioneering work in the investigation of primary factors in intelligence was done in the 1930's by L. L. Thurstone (1938). In one of his experiments, Thurstone administered to high-school and college students a battery of fifty-seven tests designed to measure general intelligence. Using factor analysis, Thurstone was able to determine the extent to which various tests measured the same factor or ability. From this and subsequent experiments, he identified seven separate factors of intelligence: verbal comprehension, word fluency, numerical ability, space visualization, memory, perceptual ability, and reasoning.

He then developed seven separate tests, each aimed at measuring one, and only one, of the seven factors.

If he had succeeded in breaking intelligence down into seven unique components, scores from these tests would have shown no correlation with each other at all. But when he administered the tests to a new group of students and computed the correlation coefficients between each test and every other test, he found that the tests *were* correlated. This could mean that in addition to the special factors there was a general intelligence factor, as Spearman had postulated, that could not be subdivided. Or it could simply mean that he had not succeeded in devising "pure" enough tests. The fact that Thurstone did not succeed in developing uncorrelated tests cannot be taken as proof that it cannot be done. Whether or not there is such a thing as general intelligence, in addition to the primary abilities, is still in dispute today.

Perhaps Thurstone's failure to analyze intelligence entirely into unique components was due to the fact that there are actually many more separate factors than Thurstone had postulated. A new series of studies is presently being conducted which classifies all intellectual abilities into a systematic framework called the *structure of intellect* (Guilford, 1961). According to this model, human intelligence can be broken down into 120 factors. Tests for each factor are gradually being worked out; tests for about half of them are now on hand.

This theoretical model is analogous to the chemist's periodic table of the elements. By means of such a systematic framework intellectual factors, like chemical elements, may be postulated before they are discovered. In several cases this has in fact happened: abilities postulated on the basis of the model have later been successfully isolated for the first time. This approach is a fundamental breakthrough in psychology.

It is to be hoped that in the future unique tests will be developed for each of these factors—tests that measure a particular factor well, and only that particular factor.

One widely used set of aptitude tests, the *Employee Aptitude Survey*, was put together on the basis of factor analysis and practical validity studies (Ruch and Ruch, 1963). Although the EAS tests are not factorially pure, their factor

content is known. This battery includes the following ten tests.

Test 1—Verbal Comprehension. This is a thirty-item multiple choice test of word knowledge. The items are of varying difficulty, arranged in order of difficulty, ranging from words which practically everyone knows, through words of moderate difficulty, to extremely difficult words. The items were carefully selected to insure that no special occupational or interest groups would have a special advantage.

Test 2—Numerical Ability. This is a seventy-five-item multiple choice test of the ability to do arithmetic rapidly and accurately. It is divided into three separately timed parts, one dealing with facility in working with whole numbers, one measuring facility with decimals and the third measuring facility with fractions. Within each part, items are arranged in order of difficulty.

Test 3—Visual Pursuit. Consisting of a maze of lines through which the examinee must visually trace a path, this test measures a specialized type of perceptual ability involving pursuit movements of the eyes.

Test 4—Visual Speed and Accuracy. This test consists of 150 pairs of groups of typographical symbols. The task is to compare each pair and determine as rapidly and accurately as possible whether the two groups are the same or different.

Test 5—Space Visualization. This is a test of the ability to translate a two-dimensional drawing into three-dimensional space. It consists of a series of block piles. The examinee must determine, on the basis of his three-dimensional visualization, how many blocks specified blocks are touching. Sometimes, he may determine this directly; in some cases, he must deduce this by visualizing the "hidden" portions of the block piles.

Test 6—Numerical Reasoning. This test consists of twenty number-series items, arranged in order of difficulty. The examinee must study each series, discover the rule used in constructing the series and apply this rule in order to determine which of several alternative numbers should come next.

Test 7—Verbal Reasoning. This is a measure of the ability to analyze verbally stated facts and to make valid judgments on the basis of their logical implications. An important feature of this test is that it measures the ability to decide whether or not sufficient facts are available to reach a definite conclusion. The test consists of six sets of "facts,"

each followed by several "conclusions." The examinee determines on the basis of the facts alone whether each conclusion is definitely true, is definitely false, or could be either true or false.

Test 8—Word Fluency. This is a measure of ease in verbal communication. In contrast to Test 1, Verbal Comprehension, it measures speed and freedom in using words rather than the understanding of verbal meanings. The examinee is given a letter of the alphabet and told to write as many words which begin with that letter as he can think of in five minutes. The meaning and spelling of the words are not important. The emphasis is on the speed with which he can think of different words.

Test 9—Manual Speed and Accuracy. This test is a measure of the ability and willingness to make precise, repetitive movements of the fingers rapidly and accurately. This type of coordination is often called finger dexterity. The test consists of a series of circles of about one-eighth inch diameter. The examinee places a pencil dot within as many circles as he can in five minutes. Owing to the monotony of this task, it requires considerable perseverance to stay with it even for five minutes.

Test 10—Symbolic Reasoning. This is a high-level test of the ability to comprehend relationships which are presented symbolically, and make valid deductions from them. An important aspect of this test is its measure of the ability to evaluate whether adequate information is available to make a definite decision. The test consists of thirty items arranged in order of difficulty, each item being a complex symbolic relationship followed by a possible conclusion. The task is to decide whether the conclusion is true, false, or indeterminate.

TESTS OF ACHIEVEMENT OR PROFICIENCY

By a test of achievement or proficiency we mean one that measures present performance in some job or part thereof. A test of typing proficiency, for example, measures how well secretaries, stenographers, and typists can type. Proficiency tests are, in effect, a sample of the criterion and in this respect differ from the test of aptitude, which presents problems different in form from the criterion. The *Dictionary of Occupational Titles* describes hundreds of achievement tests to measure progress in school subjects, skilled trades, and many other areas. In addition to these, the Armed Services

have developed a large number of proficiency examinations to test knowledge and skill in the various military occupational specialties.

Since the type of knowledge and skill required for various jobs is so enormously varied from one organization to another, many of the larger employers have developed skills tests for their own use based on careful analysis of the demands of the jobs in their particular organizations. Generally speaking, these tests are not available to the general public.

The reader should not get the impression that all tests of job knowledge and skill, or all aptitude tests for that matter, are printed tests. There are a number of apparatus tests, but in general their use is declining except in very special cases. There are two basic reasons for this. In the first place, the apparatus tests are too expensive for the amount of information they yield over and above that which can be gained from printed tests that are readily administered to groups of applicants in a comparatively short period of time. Apparatus tests often contain intricate moving parts which get out of order unless carefully maintained. Secondly, apparatus tests can ordinarily be given to only one applicant at a time, thus making administration costs excessive. However, since most Americans are "gadget lovers," the motion pictures and television shows we see practically always show apparatus tests in use rather than printed tests.

TESTS OF MOTIVATION

We shall now leave the study of ability tests, which involve maximum performance on the part of the individual taking the test—the so-called "can do" tests—and turn to the study of tests aimed at the measurement of the motivational or "will do" aspects of the human being. A convenient breakdown for this purpose is: interest tests, temperament tests and values tests. Incidentally there is a current trend in the direction of limiting the word "test" to instruments calling for maximum performance and toward calling the devices aimed at the assessment of motivational factors by such names as "survey" or "scale" or "questionnaire," since experience has shown that people generally are less acceptant of the term "test" in connection with the motivational side of their nature than in connection with the aptitude and proficiency side.

Interest Tests. Interests can be defined as feelings of like, dislike, or indifference toward an activity, object, or occupation. Interest tests may be *empirical*, *factor analytic*, or *logical*. Each of these types may further break down into *normative* and *ipsative* tests. A good example of an empirical test is the Strong Vocational Interest Blank (1951). This device was developed by asking hundreds of questions of people in various occupations such as physician, lawyer, engineer, real estate salesman, life insurance salesman, accountant, etc. These individuals were asked to express their feelings with regard to a wide variety of activities that are familiar to all of us through daily living. The frequency of each answer given by each occupational group was tabulated and these findings treated statistically to give each item answer a weight proportionate to the degree to which that answer differentiates between the average member of a particular occupational group and people in general. The Strong Vocational Interest Blank is a normative type test in that an individual can be above average in interest for any number of occupations.

In the ipsative type test the individual is compared not to some outside group but to himself. A typical example of this is the Kuder Preference Record, in which the respondent is required to choose from each group of three activities the one he likes most and the one he likes least, leaving the third unmarked (Kuder, 1942). An example of the type of items in the Kuder Preference Record follows.

Would you prefer to

- a. Develop new varieties of flowers?
- b. Conduct advertising campaigns for florists?
- c. Take telephone orders in a florist's shop?

The person who chooses *a* would receive credit for scientific interest. The subject who chooses *b* would get a plus on the persuasive (or sales-mindedness) component. The choice of *c* is counted as clerical interest. There are a total of ten dimensions measured by this test, the nature of which are fairly obvious from their titles: outdoor, mechanical, computational, scientific, persuasive, artistic, literary, musical, social service and clerical. Unlike the normative test, the ipsative Kuder test does not permit a person to be above average in all of the dimensions listed above. In everyday words, we might say he gets a high rating

in certain interests only at the cost of a low rating in others. The Kuder test falls into the logical category, since it was not developed by factor analytic methods or by empirical comparison of occupational groups, as was the Strong Vocational Interest Blank.

A recently published interest test built through the use of factor analytic methods is the *Guilford-Zimmerman Interest Inventory* (Guilford and Zimmerman, 1962). This test is of the normative type and includes the following ten factors, whose titles are quite descriptive: mechanical, natural, aesthetic, service, clerical, mercantile, leadership, literary, scientific, and creative. This test was built for vocational guidance of college students and has good norms for such a purpose.

Correlations between interest tests and occupational success have typically been low and positive. Probably the reason for this is that such tests, developed originally for vocational guidance, where honesty on the part of the person taking the test can be assumed, are too open to faking when used as a part of the employment procedure. Despite the limitation of fakability, tests of this nature do have a real value, however, especially in eliminating those who are unfitted for a particular job by virtue of their low interest scores for that job.

Temperament Tests. One of the most commonly accepted definitions of temperament regards it as a pattern of stable tendencies or ways of reacting to external stimuli. This is a way of saying that certain persons are set to react to a given situation in a manner characteristic of them and differing from that of many other people.

There are two basic types of temperament tests—sometimes called personality tests—self-inventories and projective tests. The first and most useful type is the inventory, in which the person indicates whether a statement does or does not characterize his usual feelings and behavior. The most valuable temperament tests based on report of self-observations have been developed through the use of factor analysis in a manner similar to that which was used to isolate the unique dimensions of ability. One of the best known of these is the *Guilford-Zimmerman Temperament Survey*. This survey measures ten fairly independent factors. These are:

1. *General activity.* A high score on this factor indicates strong drive and energy; a very high

score, however, may be a sign of random activity and wasted effort.

2. *Restraint.* While the happy-go-lucky, care-free individual will obtain a low score on this trait, the responsible, serious, conscientious person tends to obtain a high score.

3. *Ascendancy.* This score indicates the individual's degree of dominance over others in social situations. Usually a high score is desirable in persons being considered for supervisory positions; however, this should be balanced by good scores on other factors, such as Friendliness and Thoughtfulness.

4. *Sociability.* The high scorer enjoys the company of others and finds it easy to get acquainted with them.

5. *Emotional stability.* A high score indicates optimism and a steady disposition, not subject to wide swings in mood from day to day, while a low score shows poor mental health or neurotic tendencies.

6. *Objectivity.* The high scorer usually can take criticism without having his feelings hurt, while the low scorer tends to be a touchy, hypersensitive individual. However, too high a score may indicate that a person is too insensitive himself to be able to appreciate the possible sensitivity of others and hence is likely to hurt their feelings unwittingly.

7. *Friendliness.* A low score on this trait indicates some form of hostility. A high score may mean either a healthy, realistic handling of injuries or a lack of fighting tendencies to the point of pacifism or, in some instances, a strong desire to be liked and to please others. Too high a score may thus be undesirable in persons in positions of leadership or authority.

8. *Thoughtfulness.* The introvert scores high on this trait, while the "doer" tends to score low. Those who show too low a tendency toward reflection and planning may also be lacking in subtlety and tact because they are too busy reacting with their environment to take the necessary time to observe other people and their reactions properly.

9. *Personal relations.* This trait represents the core of getting along with others, a high score indicating a high degree of tolerance and understanding and a low score showing a tendency toward criticalness and suspicion.

10. *Masculinity.* Men who score high tend to

behave in ways characteristic of men and therefore to be well understood and accepted by other men. However, too high a score may indicate a rather callous, unsympathetic nature, or may, in some cases, show an effort to compensate for some feeling of weakness. High scores made by women may indicate rebellion against the feminine role or may simply show that long association with the opposite sex has produced masculinizing experiences and tendencies.

The Guilford-Zimmerman test is somewhat susceptible to faking but works fairly well in employee selection despite this fact. Like the interest tests, it works best by detecting the individuals who are poorly suited to meet the demands of a particular job.

Many critics of motivational tests point to the fact that such tests can be faked, but overlook the fact that they work in spite of this. Certain of the widely used motivational tests have some sort of "lie detector" scale developed along the lines first reported over 20 years ago (Ruch, 1942; Meehl and Hathaway, 1946; Jacobs and Schlaff, 1955). There is some reason to believe that for certain uses the lie factor correction actually interferes with the predictive power of the test. This is an involved problem and cannot be examined here in detail, but the practical answer is to try both ways. That is, the uncorrected and the corrected scores should be correlated to the criterion to see which has the more predictive validity.

Because the fact that many temperament tests are easily faked is well recognized by psychologists, attempts have been made to develop non-fakable tests. Let us examine two such attempts.

In an attempt to eliminate faking, another self-inventory was developed through the use of factor analysis. It consists of two similar tests which may be used separately or in combination—the Gordon Personal Profile (1953) and the Gordon Personal Inventory (1956), both of which make use of the forced-choice technique to minimize fakability. The Profile, consisting of eighteen sets of tetrads, measures four factors—ascendancy, the tendency to take the lead in group situations in a self-confident manner; responsibility, the ability to stick to a job and get it done; emotional stability, freedom from anxiety and nervous tension; and sociability, or liking to be with and work with people. A total score, consisting of the total number of items

marked in a favorable way minus the number of unfavorable responses made, is also given. Although a high score may be an indication that the individual has tried to "beat the test," this is not necessarily the case, since many persons genuinely have a good opinion of themselves. However, a low total score is of value in indicating feelings of inferiority and a poor personality adjustment.

The Gordon Personality Inventory is similarly composed of tetrads (twenty in this case) in which the individual marks the item most like himself and the one least like himself in each tetrad. The four traits measured—cautiousness, original thinking, personal relations (trust in people and tolerance or understanding of others), and vigor or tendency to move and work rapidly and energetically—are independent of those measured in the Profile, so that the two instruments may be used together to provide a more complete picture of the personality. A very low total score on the Inventory has not been found to indicate personality problems, as in the case of the Profile, but is to be subjected to further study.

During the development of the Gordon Personal Profile a test was made to see whether the forced choice format would be superior to the ordinary questionnaire in producing valid results (Gordon, 1951). The same items were included in two different tests measuring the four personality factors of ascendancy, hypersensitivity (emotional stability), responsibility and sociability—one test a straight questionnaire, the other composed of forced-choice tetrads. The tests were administered at a college dormitory for women, followed by a nominating session in which each woman nominated three girls from her corridor who were most characterized and three who were least characterized by descriptions of each of the factors. These nominations were used as a criterion for validation of the tests. The forced-choice test proved to be more valid than the questionnaire.

A later study was designed to test the fakability of the Gordon Personal Profile (Rusmore, 1956). The test was administered to eighty-one college students twice, with different sets of instructions each time. For the first administration the students were asked to imagine that they were taking the test as part of the process of applying for a job which they wanted very much to get. The second time they were to imagine that they were taking

it as part of a vocational guidance program. In general they had a slight tendency to show themselves to better advantage in the simulated job-selection situation; however, only the Responsibility scale showed a significant difference in favor of that situation over the vocational guidance situation. This difference amounted to about nine percentile points. These results were interpreted as showing that the Gordon Personal Profile was probably less subject to faking than nonforced-choice tests.

In *projective* tests the subject responds to relatively unstructured stimuli, such as ink blots or pictures, and is asked to tell what he sees or what is going on. The examiner evaluates the subject's temperament on the basis of these responses. Here again, popular appeal does not predict utility. Although the familiar Rorschach ink blots feature frequently in motion picture and television shows involving psychologists, psychiatrists, and personnel interviewers, there is virtually no evidence that they yield information useful in predicting success on the job. In fact, one able psychologist, after searching the pertinent literature, came to the conclusion that such tests will not, in and of themselves, predict any kind of overt behavior (Gleser, 1963).

Tests of Values. One interesting approach to the measurement of values, or what might in everyday terms be called "philosophy of life," is based upon the philosopher Spranger's types of men (Spranger, 1928). According to Spranger, people have six basic values in life: *theoretical, economic, aesthetic, social, political* and *religious*. A test which was devised to measure the relative importance of these six basic motives in an individual's personality is the Study of Values test (Allport, Vernon and Lindzey, 1960).

The man predominantly motivated by *theoretical* values has as his primary aim in life the discovery of truth. In pursuing this goal he characteristically seeks to observe, to reason, and to organize his knowledge in a systematic manner, without being influenced by the beauty or the utility of the objects he is studying.

The *economic* man, on the other hand, is primarily concerned with what is useful and thus with the practical affairs of business—production, marketing, credit, wealth. Often this attitude conflicts with other values, since the economic man

regards pure science, as opposed to applied, as worthless and has little regard for art except as it serves commercial ends. He tends to confuse luxury with beauty.

In contrast, the *aesthetic* man places form and harmony above all other values, regarding commercial activity as destructive of these. Even though he may not be a creative artist himself, he finds his chief interest in the events of life as artistic episodes from which he derives aesthetic enjoyment. The aesthetic, with its emphasis on diverse impressions to be savored, is also in contrast to the theoretical, which emphasizes the identities of experience. The aesthetic man tends to be a strong individualist, not a "company man."

Love of people is the highest value for the person high in *social* values. He tends to support social-welfare programs and to be personally warm and helpful to others.

Whether in the field of politics as such or not, the *political* man is most interested in power over others, desiring to influence their opinions and to gain renown as a leader of men.

Although not necessarily orthodox in his beliefs, the *religious* man has as his highest value the unity of the universe. This classification of men includes the "immanent mystics," who find their religious experience through active participation in life as a whole, and the "transcendental mystics," who seek the highest through withdrawal from the ordinary plane of living and become ascetics or monks.

Naturally, there is no such thing as a pure aesthete with no interest in worshiping, helping others or making a living. Nor is the most dollar-minded businessman completely insensitive to beauty or to the needs of others. Everyone has a mixture of these six basic motives, and by measuring which are most dominant in his personality and to what degree he possesses the others, a picture of his temperament in terms of philosophical values may be attained.

The Allport-Vernon-Lindzey Study of Values is an ipsative test; a high score on one set of values can be earned only at the expense of gaining low scores on another set.

BIOGRAPHICAL DATA METHOD (WEIGHTED APPLICATION BLANK)

Clearly the most widely used method of getting information upon which selection decisions can

be based is the application blank. Application blanks typically include questions to bring out such items of information as age, sex, marital status, number of dependents, amount and nature of education, number of jobs held in the last five years, entry pay on last job, rate of pay at time last job was quit, and many others that relate to the style of living and life pattern of the applicant. Although some form of application blank is used in almost 100 per cent of employment situations, this information is rarely used efficiently because the employer or his personnel man does not know the meaning and significance of the information collected. It is possible to analyze the information in the application blank in relation to the employee's performance on the job. When this is done the *bio-data method*, as the technique is called, is typically the quickest and cheapest way of estimating the emotional stability and overall employability of an applicant.

The method of determining weights consists essentially of the following steps:

(1) The application blank is administered to all applicants.

(2) Some of the applicants are hired and placed on the job.

(3) After a sufficient time has elapsed the applicants are divided on the basis of their job performance into satisfactory and unsatisfactory halves. This division is sometimes made on the basis of how long they stayed on the job. For example, employees on a simple semi-skilled job who stay six months or more might be regarded as satisfactory and those who quit sooner than that as unsatisfactory. In technical language this is the criterion of job tenure. In other instances the employees are rated by their supervisors on the basis of the quantity and quality of their job performance into a satisfactory and an unsatisfactory group.

(4) At this phase the proportion of successful workers and of unsuccessful workers choosing each alternative or possible answer on the application blank is determined by tabulating the frequency of each answer to each question within each of the two groups.

(5) In this step, weights are assigned to each answer on the basis of the degree to which successful people are differentiated from unsuccessful people by the answers given. The study of the

various techniques of weighting each answer to yield maximum information gets us into a fairly complex phase of statistics. In general, however, it would go something like this.

Marital status: Single, -1 ; married, $+1$.

Age (at date of hiring): 15-25, -1 ; 26-30, 0; 31-45, $+1$.

Pay on previous job: Above starting pay for job applied for, -1 ; below starting pay on job applied for, -1 ; about equal to pay on job applied for, $+1$.

(6) Once the weights have been derived for the significant items, a key is developed which gives a total score by algebraic addition of the plus and minus weights assigned to each applicant's answers.

In a recent study aimed at predicting turnover of clerical personnel working in an oil company credit-card billing department, it was found that under normal conditions 80 per cent of the terminations occurred within the first year of employment (Shott, Albright and Glennon, 1963). When the bio-data method was introduced, it was discovered that length of employment could be predicted for men with a correlation of .48 and for women with a correlation of .36. In other words, the scoring system correctly classified 69 per cent of the individuals hired, in contrast with the earlier selection methods, which had correctly classified only 45 per cent. Thus the bio-data method resulted in increasing the "batting average" by over 50 per cent.

THE PERSONAL INTERVIEW

The personal interview is still the most frequently used single method of selecting employees. Its widespread use, however, is based more on faith than on demonstrated validity. As a matter of fact, relatively few careful studies have been made of the validity of the interview as a selection procedure, probably because it is the oldest method of personnel selection and its traditional status saves it from critical appraisal. The few studies of the effectiveness of the interview which have been scientifically conducted have shown a surprising lack of value in this time-honored procedure. Specific results, however, have varied widely and depend upon the type of interview.

Interviews can be classified into four major

categories: *unstructured* (the most common); *non-directive*; *structured* (patterned) and *stress* (very rare).

UNSTRUCTURED INTERVIEW

By far the most common form of the interview is the casual, poorly organized one in which the points to be covered and the order in which they are covered are left to chance and the discretion of the interviewer. The typical employment interviewer in industry is a person without much specific training in interviewing techniques or in the principles of human behavior and motivation. For this reason the interview, despite its wide use, is a fairly dull tool in personnel work.

Studies of the effectiveness of the unstructured interview have shown its reliability to be little better than chance. In one classic study (Hollingworth, 1929), 57 applicants for sales positions were interviewed and rated independently by 12 sales managers. Comparison of the ratings showed very little agreement among these experienced sales managers. For example, one applicant was ranked in first place by one interviewer and in 53rd place by another.

As discouraging as this and other earlier studies were, we find that more recent and much more extensive evidence is equally discouraging. In one validation study of some 3246 naval personnel assigned to schools on the basis of personal interview and psychological test scores, it was found that the interview actually detracted from the results which would have been obtained by the test scores alone (Stuit, 1947).

NONDIRECTIVE INTERVIEW

In the nondirective interview the procedure represents an adaptation of the counseling interview technique developed by Rogers and described in Chapter 15 of this book. The interviewer using this method encourages the applicant to talk on topics the applicant thinks important. The interviewer asks few direct questions but spends most of his time listening and making notes. The theory of this procedure is that the applicant will spontaneously cover most points of interest to the interviewer.

This type of interview procedure is seldom used because it requires considerable skill and training on the part of the interviewer. The few companies

that do make use of this method, such as the Bell Telephone Company of Pennsylvania, report good results. It should be noted, however, that their interviewers are carefully trained and that they base their final recommendations not only on the interview results but also on bio-data and careful checks with previous employers.

Perhaps the best thing to be said for the non-directive interview is that applicants like it. They report pleasant feelings as from a social conversation with a good friend and not that they have been put through some sort of grilling inquisition.

STRUCTURED (PATTERNED) INTERVIEW

In the structured interview the questions to be asked, the order of asking them, and the amount of weight given to each applicant's answers are carefully worked out in advance of the interview. This has been called the "oral bio-data blank." As in the bio-data method, only questions are used that are designed to bring out information in areas found to be important through careful analysis of past experience. The structured interview is a systematic attempt to attain and evaluate information on the applicant's qualifications and personal characteristics. It is not surprising, therefore, to find that its reported validities are usually higher than those found with the unstructured interview.

The leading advocate of this technique of interviewing is McMurry, who calls it the "patterned interview." This psychologist has published numerous studies showing significant relationships between interviewer ratings and subsequent job tenure and job performance as measured by supervisors' ratings.

The structured interview, when properly conducted, is superior to the unstructured in a number of ways. In addition to having a definite plan, the interviewer works from definite job specifications and has already checked with previous employers in order to have considerable information about the applicant. Also, the interviewer should have some training in the techniques of conducting an interview so as to gain the most pertinent information about the applicant and should have certain clinical concepts (such as that of emotional immaturity) to aid him in interpreting this information. The interviewer should himself have been carefully selected, but he need not be a psychologist to be able to attain good results.

Why has this kind of interview consistently yielded valid results? There are five major reasons:

- (1) The questions asked are based upon job specifications.
- (2) This means that the interviewer knows what to ask. He is prepared for the interview.
- (3) Scoring methods are clearly spelled out. For example, an applicant gets a plus for being happily married and a minus for being recently divorced.
- (4) Interviewers are well trained.
- (5) Interviewers also made telephone reference checks with previous employers. Thus their ratings were not dependent solely upon information obtained in the interview.

Since nothing is perfect, the student may ask what are the disadvantages of the patterned interview. The answer is that there are two of them.

- (1) The method is expensive and time consuming to develop and administer. It is therefore usually restricted to higher level jobs, although, as we have seen, it will work for skilled and semi-skilled jobs as well.
- (2) Its validities are no higher than those obtainable by use of the cheaper methods of bio-data analysis and standardized psychological tests.

STRESS (SITUATIONAL TEST)

In the stress interview or situational observation the interviewer attempts to place the applicant under stress, either through asking him probing questions or by putting him in a difficult situation. An example of the probing question might go something like this: "If you had a subordinate who would not do something you asked him to do, what would you do about it?" After the applicant has answered to the best of his ability, the interviewer would say, "What if he still won't do it?" In the stress situation approach the applicant is asked, without warning, to talk for ten minutes on an unfamiliar topic, or he is given a newly formed group of men and asked to have them accomplish a difficult task such as assembling an object or solving a puzzle. A troublemaker will be planted in the group to do his best to frustrate the applicant's efforts to direct the performance of the job.

This type of interview is infrequently used because it requires a great deal of skill on the part of the interviewer, it runs the risk of making the candidate so angry he will refuse the job if offered to him and, most important of all, its validity is still open to question. This method was used extensively in the selection of OSS agents who worked behind enemy lines in World War II wrecking bridges, destroying factories whose output was vital to the enemy's war effort, and performing similar types of assignments (Staff Office of Strategic Services, 1948). Another application was in the selection of clinical psychologists. In both cases it was found that the stress method was scarcely worthwhile. Although it had some validity, it added little to the accuracy of prediction obtainable from other objective sources such as bio-data and psychological tests. Because of its great cost and mediocre contribution of predictive information it is not widely used today, although its "cloak-and-dagger" history gives it a glamor which is irresistible to some employers.

OTHER OUTMODED METHODS OF SELECTION

As we have seen in the discussion of the interview, employers cling to traditional methods and do not demand proof of their effectiveness. Among the methods of little value that are still in use are: letters of application, letters of recommendation, photographs of face, and body measurements.

LETTERS OF APPLICATION

Letters of application, although still widely used, have only limited value as a means of judging the fitness of an individual for a particular job. Often the information such a letter includes is very general and tells little of the applicant's capacity to do the work required. The prospective employer has no assurance that the letter was actually written by the applicant. Nevertheless, many employers still require letters of application; it is, therefore, important to the applicant to be able to write a good one. It is also customary to enclose a complete and accurate record of past employment, together with a list of personal and business references. Many employers still require a list of references from nonrelatives of the applicant. The wise applicant will select these with care!

LETTERS OF RECOMMENDATION

Letters of recommendation cannot always be taken at face value. A past or current employer, for example, is not an unprejudiced source of information. A present employer may write a falsely enthusiastic letter about an unsatisfactory employee in hopes that he will change jobs. Conversely, an employer who wants to retain an able employee may write a less favorable recommendation than the employee actually deserves, in order to retain his services. Employers and friends alike are prejudiced by their personal relationships with the applicant and, in general, hesitate to mention characteristics that might prevent an applicant whom they like from getting the job he wants. Still another weakness of the letter of recommendation is that the writer is often too busy to look up the records necessary for making an accurate report of the applicant's performance.

Recommendations from former employers and co-workers may also be obtained through questionnaires sent out by the company which is considering hiring the applicant. Employment recommendation questionnaires of this type have the advantage of being more uniform than letters, but they are of little more value in predicting the success of an applicant. Their value could, no doubt, be increased by following the procedures outlined for developing a sound selection program.

In one study, employment recommendation questionnaires were objectively scored for applicants for twelve skilled jobs. The scores proved to have practically no value in predicting ratings later received from supervisors. Evaluations of character showed slightly higher validity than did those of ability but were not very efficient predictors (Mosel and Goheen, 1958).

PHOTOGRAPHS

Careful research has demonstrated clearly that even trained personnel workers cannot judge from a photograph the likelihood of an individual's success or failure.

Using autobiographical sketches published in connection with a university class reunion, two psychologists selected five successful and five unsuccessful men each in the professions of law, medicine, education, and engineering (Landis and Phelps, 1928). The biographies were accompanied

by two photographs of each individual—one taken at the time of graduation and one taken twenty-five years later. Two other psychologists projected these photographs on a screen and asked judges to rate them as successful or unsuccessful. Two groups of judges were used—college students and trained personnel workers. The judgments of neither group were better than chance (Viteles, 1932).

BODY MEASUREMENTS

The notion that the cast of features, shape of head, or other aspects of body type reveal ability and motivation is not new. However, modern psychology has shown this notion to be false. In one study of whether or not it is possible to estimate intellectual level from facial characteristics, subjects were 317 airmen in training at a radio school (Ray, 1958). Aside from facial contours, they were remarkably homogeneous in appearance, since all were about the same age, all had military hair cuts and all wore summer uniform, carrying their hats in their hands. Those who wore glasses left them off. Subjects walked one at a time slowly across a low stage and back. The judges—five peers, five student counselors, and five supervisors of instructors in the school—were asked to classify each subject in the upper or the lower half of students in the school. The actual separation of the men into halves on the basis of a measure of general intelligence—the Air Force Qualification Test—was the criterion against which judgments were compared. Judgments agreed with the criterion classifications in only 50.07 per cent of the cases. Thus the ability of the judges to predict intelligence from facial characteristics was no better than chance.

TESTING THE TESTS

Some ancient wise man whose name has been forgotten said, "The proof of the pudding is in the eating." The modern personnel psychologist takes that point of view in his work.

ANALYZING EACH ITEM OF INFORMATION

The personnel psychologist asks himself how well each bit of information concerning an applicant predicts success on the job when considered by itself. This is step (4) in the master plan set forth on page 287. He also asks what is the cost

in time and materials of obtaining each bit of information.

If an item of information is not predictive by itself, the chances are very great that it will not predict when combined with other information.

COMBINING ITEMS OF INFORMATION

This is step (5) of the plan presented on page 287. Each bit of information—whether it be a test score, a bio-data item or something else that has been shown to be predictive—is combined systematically with every other bit to see how much it adds. If it adds nothing, it is dropped from further consideration. The exact procedure for doing this is even more complicated than that required to analyze the various bits by themselves. These procedures are called *validation*. To validate an item of information or a combination of such items it must be shown that workers who are high in their criterion scores get higher predictive scores than do those who are low on the criterion.

TYPES OF VALIDATION DESIGN

There are two designs used in empirical validation studies: concurrent validation and predictive validation.

Concurrent Validation. This design is sometimes called the *present employee method*. In this procedure present employees whose criterion scores are known are cast into a good group and a poor group and steps (4) and (5) are performed.

Predictive Validation. In this method, applicants are tested and other bits of information are gathered on them. The applicants are hired without regard to such information and placed on the job. After a suitable period of time has elapsed, their criterion scores are obtained and steps (4) and (5) performed.

Generally speaking, predictive validation is the more desirable of the two procedures, but it is less often used because of the delay involved in waiting for the criterion to mature.

If the method of concurrent validation is used, the poorest employees will not be adequately represented, since they will have quit or have been discharged. This restriction of range can only mean that indices of validity obtained will be smaller—that the true value of the selection program will be greater than the apparent value.

There are two other disturbing factors at work in the method of concurrent validation. Employees

who know that their work is satisfactory will not be as motivated to make a good showing in tests as will applicants. Also the range of age will generally be somewhat greater among present employees than among applicants. This can be a disturbing factor.

COSTS AND SAVINGS

In performing steps (6) and (7) the personnel psychologist acts and thinks like a businessman. Having decided what the bits of information are that predict success, he gathers such information on all applicants for the job, keeping an accurate account of all costs involved. After the program of selection has been in force for some time, he analyzes his experience, summarizes it in terms of dollars saved and reports this to his company's top management. If the costs of the program exceed the savings, it is not a good program.

IN CONCLUSION

The methods and findings given in this chapter are concerned with the way the personnel psychologist helps management earn better profits through reducing costs. His efforts reduce costs by identifying in advance of employment those individuals who will learn most rapidly and will perform most efficiently. Guiding all of the efforts of the personnel psychologist is the principle that "the proof of the pudding is in the eating." It is true that he looks to the theoretical psychologist for hypotheses, but in the end he is content when his empirical validity studies show that information attainable on the applicant before the time of hiring will predict subsequent job performance.

In the course of his researches over the half-century period beginning with World War I, he has frequently found that traditionally accepted methods such as the unstructured personal interview, the letter of application or recommendation, the photograph or body measurements are not as effective as the more modern procedures. Curiously, some of the personnel selection procedures criticized most severely by journalists and other laymen proved to be among the most effective. In the long run the personnel psychologist is more interested in management's evaluation of him than in that of the popular writer, and the verdict of top management is quite clear, as shown by the upward trend in the utilization of those selection

devices which the psychologists have created and improved over the past fifty years. There is still much room for improvement, however, and the industrial psychologist is first to welcome the findings of the theoretical psychologist.

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CHAPTER 18

Managerial Psychology

In addition to the scope shown in the chapters on selection by Ruch and on human factors by Warren, industrial psychology includes a study of the work environment. Work environment can be considered to be the physical environment such as lighting, heating, ventilation, etc., but of much greater importance, as recognized since the Hawthorne studies, has been the psychological environment. This psychological environment includes factors of motivation, influence, status, and organizational structure.

The purpose of industrial psychology is to make the industrial organization more effective by helping the manager to understand, predict, and control the pertinent human variables. This objective of efficiency within the organization generates issues of two major types. While the welfare of the organization is the primary concern, there may be a conflict involving the welfare of employees which many sociologists and some psychologists maintain should be the objective. A second related issue is that of the relative emphasis on productivity versus morale. Or the question is, maintaining fitness at work—for what? While certainly the implication is to work another day, there has been controversy as to the relation between productivity and morale, and as to the employer's responsibility for morale. Consequently one needs to specify the assumption as to what span of time is considered when maintaining fitness at work. It is assumed in this chapter that there is a time span of several years being planned rather than a shorter period.

RELATION OF PSYCHOLOGY TO SCIENTIFIC MANAGEMENT

It is necessary when considering the applications of psychology to maintaining fitness at work to consider the scientific management movement. Scientific management has been largely responsible for the industrial eminence in the United States. There are conflicts between psychological concepts for maintaining fitness at work and those of scientific management. This is true especially in the psychological environment. Scientific man-

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agement is an engineering approach. It includes a number of points. There is the attempt to improve work methods by seeking the one best way for each task. There is motion study to make sure that each employee is performing according to the "one best way." Time study is used to find out the average time for a competent worker so this standard may be used in setting an individual incentive pay rate with the expectation that employees will attempt to work as hard as possible to maximize their earnings.

Scientific management also includes breaking labor into its simplest components. Each job is simplified—for example, that of the man on the automobile assembly line—in order that each worker can become thoroughly expert in his few tasks.

The organization is structured for close supervision and control from above. Span of control is limited at the top to where no more than four to six managers report to a single boss. Span of control broadens at the bottom to twenty to thirty workers reporting to a single foreman, although there may be leadmen or other sub-bosses who have a narrower span of control between the foreman and the rank-and-file worker. The narrow span of control makes a tall organization with many steps between the top and the bottom of the organization. The presence of many steps makes it more likely that the top executives will receive a more distorted view of the fitness for work of rank-and-file workers.

Scientific management assumes that the manager should deal with his subordinates primarily as individuals rather than as members of a social group. This is the basis for individual piece-rate incentive plans and for individual performance appraisals. It ignores the full significance of cooperation with the development of informal methods for sharing and rotating work which can be effective. It is in conflict with group problem solving at the rank-and-file level, although on several occasions a group approach has been shown to be powerful in increasing motivation, productivity, and morale.

Scientific management dominates American management philosophy and practice. It will no doubt continue to do so. Applications of psychology to maintaining fitness at work have to be compromised or made gradually with the preeminence of scientific management in mind.

THE PHYSICAL ENVIRONMENT

SCIENTIFIC MANAGEMENT

Scientific management, aided in a few instances by psychology, has brought about great efficiency by motion study, time study, improvement in work methods, reduction of fatigue and accidents, and improving the physical environment by providing adequate light and ventilation, music, and freedom from excessive noise and heat (Harrell, 1958).

Motion Study. Motion study is the analysis of the elements of motions necessary for the performance of a task. The goal is to find those motions that will result in the task being performed in the shortest time. Efficiency engineers have assumed that there is one best way to carry out a task which every worker should use. There have been some spectacular instances of improving the speed of work by finding an easier way with fewer motions. Psychologists have occasionally also performed motion studies with the objective of efficiency. Psychologists, however, do not agree that all workers should be made to use just the same motions that the fastest worker uses. A worker should be shown the fastest motions and allowed to make his own choice; what is most comfortable may also be the fastest for him.

Time Study. After a manufacturing job has been motion studied, the industrial engineer then often makes a time study with a view to setting time standards and pay standards. An effort is made to study the speed of average workers or, if a time study is made of a worker who departs from the average, the industrial engineer attempts to make adjustments by judging how far from the average the worker actually is. Organized labor has objected to these adjustments and psychological studies indicate that it is not possible to be completely accurate in such adjustments. Where the object of the time study is for individual piece-rate pay setting, there is usually warfare between the employee and the engineer. The employee wants a loose rate so that he will not work so hard. He is not convinced that if he works as hard as he can that the rate will not be cut. No doubt time studies and the resultant piece-rate pay plans have resulted in some gains in efficiency, but usually not as much as expected. Often they are also a source of troublesome grievances over the

fairness of the rates, or require considerable expenditure in overhead on the engineering staff which sets the rates and keeps them adjusted for changes in work methods.

Fatigue. Fatigue can mean the reduced capacity to work, or a physiological state, or the subjective feeling of fatigue. Here the term is used to mean the reduced capacity to work due to prior work, but in other words due to the physiological state. It does not include the effect of boredom due to monotony. The problem of fatigue for rank and file workers has been fairly well mastered in present day American industry. This has been accomplished by mechanization of heavy labor, by reduction in hours of work, and by the use of rest pauses.

The forty-hour week seems to be just about optimal for the most amount of work accomplished per hour. More work can be accomplished in a week during fifty hours, but less work per hour is accomplished in the fifty-hour week than in the forty-hour week. Experience in industry in both World Wars I and II has shown that there is both reduction not only in work per hour but actual reduction in work per week when the seven-day week is used. There are differences in production rates with hours of work depending upon the type of work and the type of pay plan—whether incentive or day rate.

Rest pauses have always increased not only the amount of work per hour but the amount of work per day in the studies that have been reported. There must be some amount of rest pause that would not be so beneficial for output, but it has not been reported in the literature. The best location for the rest pause is just before the rate of production reaches its peak.

There is more of a fatigue problem among some salaried employees than among rank and file employees but when this problem exists among salaried employees it may be complicated by emotional aspects. A group of managers in a summer training program reported that they worked on an average of fifty-six hours per week. They did not express any feeling of fatigue although they reported that often their wives felt deprived of their companionship.

Environmental Conditions. Loud, continuous noise causes increased effort but more rarely results in reduced capacity to work. In other words,

production does not suffer, but effort increases. Production suffers when the temperature is too high or too low, when humidity is too high, and when lighting is inadequate. Industrial management recognizes these effects of environmental conditions and has done a good job of making the physical environment healthful.

Accident Prevention. The prevention of accidents continues to be a problem in maintaining fitness at work although progress has been made. Some companies, for example, U. S. Steel, have set the objective of maximum safety regardless of cost. Not all companies have been equally zealous about safety, but generally safety does seem to be put in the highest priority in American industry.

The greatest progress has been achieved in making work safe by studying the job and then training employees in safe practices. Getting the workers' ideas and interest via safety committees has been shown to be effective.

Views have changed on "accident-proneness" to the extent that few if any employees are believed to be completely accident-prone. The possibility of training for safety rather than selection seems to have won out, although in a few instances in the transportation industry there have been demonstrations of somewhat safer records by choosing employees whose attitudes, or emotional adjustment, or psychomotor skills are more appropriate to the job of operator of a bus, taxi, or airplane.

SUMMARY

The physical environment in American industry has been reasonably well controlled and understood for maintaining fitness at work. There are rare exceptions especially in space travel or in other military jobs with extremely unusual environmental conditions. Here, incidentally, military policy requires a thorough attempt on the part of engineering psychologists to make sure that the equipment is designed for optimal operation and maintenance, taking into account human capabilities and limitations. Furthermore, military policy requires a careful consideration of the training of operators and maintenance men.

Industry managers are generally aware of the needs for adequate selection, training, lighting, and freedom from noise, heat, fatigue, and accident hazards. They are also aware of a problem in the psychological environment of motivating rank-and-

file employees. But they do not know how the problem is complicated and even created by the philosophy and practices of scientific management to which the company is usually committed and can hardly abandon. Consequently, the remainder of this chapter will be devoted to the management problems of maintaining fitness at work in the psychological environment. Motivation is the central problem here.

THE PSYCHOLOGICAL ENVIRONMENT

HAWTHORNE STUDIES

Studies at the Hawthorne plant of the Western Electric Company provide a convenient transition to the psychological environment (Roethlisberger and Dickson, 1939). These studies were initially aimed at investigating the influence of the physical environment. First, the possible influence of increased illumination on productivity was studied. Later studies in the Hawthorne series were made on the influence of rest pauses on production and on the influence of an extra lunch on production.

Relay Assembly Room. The studies were pioneering and are still classic in showing the tangible effects of psychological factors on productivity. In a test room for assembling relays, attention paid to assemblers by supervision and management resulted in more favorable attitudes and a 30 per cent gain in productivity over a period of three years. Prior to entering the small test room from the much larger factory floor, the five girls who were experienced relay assemblers had reached a plateau of production. Environmental changes of improved lighting or rest pauses or an extra lunch were of no significance in this situation in comparison with the significant psychological variable of greater attention by management.

Bank Wiring Room. A small group of bank wiremen were observed very closely and the results were quite different from those in the relay assembly room. The bank wiremen set standards to restrict output even though they could have received more money had they produced more. There presumably would have been no undesirable fatigue had they produced more. They were afraid that management would cut their piece rate although none had experienced nor known at first hand of the company making such a cut. So here as well as in the relay assembly room a group

norm was set that was not controlled by management. In the bank wiring room the norm was opposed to that of management; in the relay assembly room the norm was similar to that of management, although management had not asked for any increase in production. This raises the question whether typically the work group will set its own norm rather than be controlled by management.

Interviewing. Over 30,000 employees were given a nondirective interview about their work at Hawthorne. In general complaints were not objectively accurate, but employees said that they felt better after talking to an understanding listener. This series of interviews and their results led to a regular program of nondirective counseling. Professional counselors spent full time listening to employees' problems. This counseling program was in effect for a number of years but has been discontinued as a staff service. Line supervisors, however, have been trained to try to listen understandingly to employees' problems.

GROUP DYNAMICS

It was seen in the Hawthorne studies that the attitudes of the work group may be either positive or negative with respect to a norm for production; in short, a work group is dynamic. This has led to studies of other work groups in industry. There have also been hundreds of studies of small groups in the laboratory. Some of these studies have implications for management in that it was found that group pressure regulates productivity.

One method of studying a group is by a method known as sociometry. Here each member of the group is asked about his activities with or feelings about each of the other members, e.g., whom he likes best in the group and whom he likes least. The results often show the presence of stars, cliques, mutual pairs, and isolates. A star is one who is preferred by many people. A clique is a subgroup. Two members may prefer each other to form a mutual pair. An isolate is preferred by no one. Such results may represent problems for the manager who wants teamwork within his group.

Role Differentiation. Leadership is specialized into several independent types or roles rather than existing as a general trait. This is true of a small group. It is even more true of leadership beyond the small group. Usually a group that has

been together for any length of time will have a task leader and a separate leader in a socio-emotional role. It is relatively rare that a "great man" will be present to occupy both of these roles. Furthermore, there is specialization from one activity to another. The best volleyball player is unlikely to be the best discussant in class, but he might be. A study of marketing cooperatives showed a specialization of leadership that may have implications for other organizations (Godfrey, Fiedler, & Hall, 1957). In the most profitable cooperatives the board chairman was typically a permissive person who listened to anyone no matter how silly his ideas were. Everyone liked him. His general manager behaved quite differently. He was more production-centered. One of the products by these cooperatives was fertilizer and it was said that any one of these general managers would fire his grandmother if she could not sell fertilizer. That these two types of leadership, the socio-emotional or best-liked, and the task leader, are found in different persons has also been noted in the military as well as other organizations.

Role is defined as "the set of expectations which group members have concerning the behavior of a person who occupies a position in a group" (Leavitt, 1964). One may have a different role in a different group. A man may be the boss at work and submissive at home. In group discussions of human relations cases in the laboratory, these specialized roles emerged more clearly after four sessions than during the earlier sessions (Bales, 1958). There was a Task-Leader who contributed the best ideas toward the solution of the problem case, and there was the Socio-Emotional Leader who was best-liked in the group of five men. Usually they were not the same person. The Socio-Emotional Leader usually talked an average amount of time, whereas the Task-Leader talked more than most.

In less than 10 per cent of the groups was there a "Great Man" who both contributed the best ideas and was also the best-liked. In the first session the best idea man was more apt to be best-liked. After four sessions of thirty minutes each, it was much more rare to find one man occupying both positions. In the first session, usually this leader, who is both the best idea man and the best-liked, talked the most. In later sessions, however, he talked less, and although he

continued to be best-liked, he no longer was judged to have the best ideas.

In addition to these two types of leaders, two other types were often observed in these small groups that also probably can be found in work groups. There was the Over-Active Deviant who talked a lot but who was often in disagreement with the majority of the group. He served a useful purpose, however, in testing the group's views and in solidifying the group. In some groups there was also an Under-Active Deviant who was quiet, and rarely saying anything. He would scarcely have been missed had he been absent.

After a Task-Leader has emerged in a discussion group, it has been found possible to upset the established structure of leadership (Hastorf, 1964). By using a system of red and green lights seen only by each discussant, the Task-Leader can be made to stop talking and a quiet member made to talk more by giving him a green light. The green light, it has been demonstrated, can encourage a previously quiet person to talk enough to take over the number one position of leadership. A red light, meanwhile, has been shown to the most talkative member as a signal for him to be quiet. Even though the increased talking by the originally quiet one was forced, nevertheless, his contributions impressed the other members of the group as being of as high quality as that which was spontaneous. This new leader continued to talk more than previously for at least one session after the experimental session in which he was stimulated by the lights. Since a quiet person does have something to contribute, it would seem advisable for the manager to make an effort in a meeting to get everyone to participate where the group is small enough.

Efforts have been made to predict who will emerge in a group of four or five persons as the most talkative (Lee, H. E., & Harrell, T. W., 1964). Talkativeness seems to depend primarily on the situation. It has been found, however, that in a discussion group of thirty minutes meeting only once, and made up of students who scarcely know each other, the most active person has often been one who almost two years later will be picked as being desired as a boss by a much larger group of his entire class of 150. There is little apparent correlation between scores on standard personality tests and talkativeness in this situation.

Types of Leadership. The impact on the work

group of the leader's behavior has been studied in a number of groups in the laboratory and in industry. One of the early classic studies compared three types of leadership: (1) autocratic, (2) democratic, and (3) laissez-faire. Laissez-faire meant no leadership, or letting the group do whatever it wanted to do. This was sharply different from democratic leadership in which the leader was active and shared with the group members the decision as to how the group was to do its work. Autocratic leadership meant that the leader made the decisions and told members of the group not only what to do but how to do it. In this laboratory situation, production and morale were highest in the democratically led groups.

Results in industry have generally supported the superiority of democratic leadership, but this type of leadership has not been widely used at the rank and file level which is where the published research results have been centered (Leavitt, 1964). Democratic leadership has often been used at management levels. Presumably the reason that democratic leadership has rarely been applied in industry at the rank and file level is because it is so out of keeping with the bureaucratic policies and procedures which dominate American business management. One of the most impressive studies showing the effectiveness of democratic leadership on productivity and morale was in a textile plant (Coch and French, 1948). A change in work methods due to a change in model of pajamas was the object of study. There were three work groups: one, the democratic, discussed the model change among themselves and decided how the work should be done; the second selected representatives to decide on new work methods for their group; and the third was told by the foreman with autocratic leadership how the work would be done. In the group with democratic leadership there was the highest productivity and most favorable morale. The group with representation was intermediate in effectiveness, while the group with autocratic leadership had the least productivity and least favorable morale.

Supervisory Practices. Leadership in small work groups has been studied in detail (Kahn & Katz, 1960). Supervisory practices were related to productivity and also to morale. Morale was defined as a combination of attitudes toward one's immediate supervisor, job, and company. Although there was a positive correlation between produc-

tivity and morale, there were many exceptions. In general, the work group that was higher than average in productivity was also higher than average in morale, and the group that was lower than average in productivity was also lower than average in morale. The more frequent exception was that a good many groups were higher than average in productivity but lower than average in morale. There were fewer exceptions of groups that were lower than average in productivity but higher than average in morale. The most likely explanation for the exceptions is that at least in the short run a first line supervisor by close supervision and engineering approaches can achieve high group productivity.

Four supervisory practices were found in those groups which were above average in productivity and generally also above average in morale. The supervisor who differentiated his duties more from those of his subordinates had higher than average morale. He spent relatively more time in planning, in organizing, on training, and attempting to motivate his employees. The supervisors who had less than average productivity spent more time in doing the same sort of things that their immediate subordinates did rather than differentiating their duties from those of their subordinates.

General supervision rather than close supervision was found in the highly productive groups. There were enough groups in several different organizations so that this difference was not due to the qualifications of the group members. As might be expected morale was also higher in the groups that were not supervised so closely.

Employee-centered supervisors had higher productivity and morale. They were seen by their subordinates as being interested in them and as helping them. The most effective supervisors stood up for their subordinates more often where there were cases of disagreement with higher management. One qualification—that one can be too employee-centered—has been suggested by other research (Fiedler, 1958). The most effective supervisor maintained some psychological distance between himself and at least one of his subordinates. He was not on completely intimate terms with everyone in his work group. He could be very friendly with his right-hand man but not with the rank and file, or he could be very friendly with the rank and file but not with his right-hand man. If he was very intimate with all—his right hand

man and with his rank and file—his group was not the highest in productivity. Presumably the explanation was that he could then not bring himself to take unpleasant disciplinary actions that might have benefited the productivity of the group.

Favorable group relations was the fourth supervisory practice that accompanied higher than average productivity and morale. Favorable group relations was found in answers to such questions as "Would you like to transfer from this work group?" High group relations was shown by an answer of "No, I want to stay with this group." Lower group relations was present in such an answer as "It would be all right to move to another group." One might wonder which is cause and which is effect. Does having a highly productive group cause favorable group relations? Or does having favorable group relations cause higher productivity? Analysis of the data showed that both causal effects were present. A highly productive group does seem to bring about somewhat better group relations. But a group high in group relations, even when it does not have objective records of its own productivity, seems to be somewhat more productive than the average as judged by competent observers who can compare it with other groups in productivity.

MOTIVATION

When managers are asked what they want to learn about psychology, their most frequent reply is "how to motivate my people." McGregor (1960) has contrasted two theories of motivation to work. The usual theory that is held today more or less implicitly he has called Theory X. Theory X is based on the assumption that people need close supervision, that they will not accept responsibility, that they are lazy, and will not find work interesting. It assumes that employees have to be controlled and watched.

Use of Theory X. Theory X acts as a "self-fulfilling prophecy." If one assumes that people are lazy and need to be watched, there is more probability that people will be lazy if they are constantly watched. There can be a hard approach of close supervision and the use of fear and coercion in management. The hard approach usually results in a vicious circle. Force by management breeds resistance or counter force by employees. This may take the form of militant unionism, restriction of output, or lack of cooperation.

Consequently management has learned not to act out its assumptions completely, but it does not know exactly what to do. It takes a softer approach of being laissez-faire as a last resort. This laissez-faire approach usually results in neither high productivity nor high morale.

It seems probable that Theory X is not correct as describing the fundamental nature of man, but it is essentially correct in describing how employees usually behave in American industry today. There is enough contrary evidence from field studies and from the laboratory to question that Theory X is necessarily true.

Theory X is reinforced by the self-fulfilling prophecy of the personnel policies and procedures of scientific management. There is no denying that employees often act as Theory X assumes, but the probability is that this is true because the situation causes them to act that way rather than that it is the only way that they can act.

The Need Hierarchy. A plausible and useful theory of motivation that is inconsistent with Theory X is that human motives can be conceived as constituting a hierarchy (Maslow, 1954). Man continues to want as long as he is alive. The goal of labor, "More," as attributed to Gompers is to an extent everyone's goal, except that it is usually not more of what we have, but more of something that we do not have. If one need is satisfied, man wants something else. On the hierarchy, or ladder, of needs physiological needs are basic. If physiological needs such as hunger or thirst are unsatisfied, man will be motivated primarily to satisfy these needs.

Safety Needs. When physiological needs are reasonably satisfied, the next to come to attention are safety needs. These include the need to avoid bodily harm plus the longer range safety of freedom from want in one's old age.

A satisfied need is not a motivator of behavior. One of the incorrect assumptions that management has made about employee motivation is that employees should be motivated to work hard because they have security and plenty to eat. These satisfied physiological and security needs are no longer motivating since they are taken for granted. New needs then become active which managers have not recognized as clearly as they have the physiological and safety needs.

Social Needs. Employees have social needs to belong to groups and these needs are often very

powerful. They were first given proper recognition in industry with the Hawthorne studies. Social needs have been shown to be stronger than the need for more money in many situations where employees have restricted their output on piece-rate pay plans. Affiliation, or the need for warm, friendly relations, is an aspect of social needs. It has been found that this need for affiliation is essentially the same among American and Iranian managers (Harrell, 1964). While culture often makes a difference in the strength of needs, in this instance there was no difference.

Ego Needs. After the reasonable satisfaction of social needs, the next to assert themselves are ego needs. One aspect of ego needs is that of power, or the need to get one's own way in a face to face situation. Iranian managers have shown a higher need for power than American managers have on a projective Test of Imagination. Presumably the difference is due generally to culture, and specifically perhaps to more autocratic child-rearing practices that cause children to follow the model of the parent.

Self-fulfillment Needs. The need for achievement or to excel in competition is an aspect of self-fulfillment. McClelland (1961) has concluded that America's outstanding material success in business has been due primarily to the great need for achievement among America's business leaders. On the other hand, he has presented evidence that the need for achievement is going down in the United States and is increasing in Russia. American managers have shown a higher need for achievement than Iranian managers in a projective Test of Imagination.

Even if one agrees that the need for achievement and self-fulfillment are important for managers and for professional persons, there is a question as to the extent to which it is realistic for this need to be gratified among rank and file employees. Although in some situations the level of skill may be higher under conditions of automation, there is even greater doubt as to whether under automation, there can be thorough self-fulfillment since the employee is locked so rigidly into the machine requirements.

Application of Need Hierarchy to Theory X. If employees have social, ego, and self-fulfillment needs, then the close supervision of Theory X will not be motivating, but frustrating. One could then expect what in fact appears—lack of interest, re-

striction of output, slow-downs, asking for more money, and militant unionism.

Theory Y. To take into account the need hierarchy and to encompass other information about motivation McGregor (1960) advanced an alternate theory, Theory Y. Theory Y assumes, as does Theory X, that the manager is responsible for the conduct of the business. The other assumptions are different from those of Theory X. They include the assumptions that man likes to work under certain conditions, that he is responsible; he is reasonable, and not stupid.

This theory is based on the assumption of general supervision rather than close supervision, of maximum delegation, and on the desirability of developing the full potential of subordinates. It is based on the goal of high standards of productivity as well as morale, but on the assumption that to achieve the maximum standards one must delegate enough direction to allow subordinates on occasion to fail. It is based more on self-control than control from a superior. It is not a laissez-faire system of letting things slide, but a theory to maximize participation of group problem-solving. The manager is seen more as a coach and a help to subordinates than one who is autocratically directing them. "It is what Peter Drucker has called 'management by objectives' in contrast to 'management by control'" (McGregor, 1960).

Difficulties with Theory Y. American industry is so geared to the scientific management principles and practices of Theory X—close supervision and individual responsibility rather than recognizing the reality of social needs—that any movement toward application of Theory Y will be slow at best. As a matter of fact, application of Theory X has brought so many material gains and Theory Y is so incomplete that it would not be possible to make a complete switchover immediately.

In some organizations only a few members of top management can satisfy their higher needs, but they have the mistaken view that other members of the organization are also satisfied. It has been said that managers are less satisfied in large companies. Porter's (1963) results, however, indicated that higher needs were satisfied as well in large companies as in small or middle-sized companies. As compared to rank and file employees, managers probably satisfy their higher needs better on the job.

While it is true that the complete adoption of

Theory Y lies at least a long distance in the future, there are several steps that can be considered now.

Decentralization and Delegation. One application of Theory Y is decentralization and delegation. General supervision which included the delegation of duties rather than close supervision was seen earlier from the Michigan studies to accompany higher productivity and morale. Where an organization has decentralized so that each manager can see the tangible results of his group he can get gratification from the achievement need. He can compete for excellence. He can plan a budget and try to stick to it to see the results of his efforts. True delegation means that one is given the chance to fail or to succeed without the close control of Theory X. To know the extent to which one has lived within a budget would no doubt be motivating. There is evidence that subordinate supervisors would like to have more say in the preparation of budgets.

Enlarging the Job. Scientific management has reduced the scope of the job so much that it is not as motivating as it would be if it were larger. The extreme case is the man on the automobile assembly line who is typically not very interested in his work, but stays because of the pay and retirement benefits. Both in the factory and in the office, rank and file employees have expressed an interest in having a chance to make more decisions about how to do their job. Research at International Business Machines Corporation has shown that by enlarging the job, there can be higher productivity as well as higher motivation.

Job rotation where one gets to know more than one job has some of the advantages of job enlargement.

Democratic Leadership. Sharing in the decisions as to how one will do a job is the heart of participative management or democratic leadership. The manager acts as a conference leader in such decision-making. There have been several demonstrations at the rank and file level in which employees set higher standards than management would set for them and in which, when given this rare opportunity to set standards, they keep to them. When employees participate in making the decision the main advantage of this group problem-solving is the acceptance of the decision rather than the elegance of the decision. Such participative management is so foreign to the policies and practices of scientific management that in spite of the favor-

able evidence it has rarely been used at the rank and file level. It has been tried much more in the ranks of management and supervisors where the evidence for its effectiveness is lacking (Leavitt, 1964).

Consultative management is intermediate between democratic leadership and scientific management. In consultative management the manager tells his employees, "This is what I think we should do and how we should do it. What do you think of this?" He consults his employees on his decision and is open-minded to change, but he does not, as in democratic leadership, share the decision-making with them before he communicates the decision. Consultative management is probably better in both productivity and morale than scientific management but not as effective as participative management. Consultative management does not allow gratification of the motivation for self-fulfillment to the extent that participative management does. Consultative management being closer to scientific management, however, is more acceptable to managers than is participative management; so maybe one should expect a gradual evolution from scientific to consultative to participative management.

Rating Performance. Many large organizations require a performance appraisal of a subordinate's work by his superior—especially in the ranks of management and supervision. This appraisal system is usually established and conducted under the assumptions of Theory X: namely, that the subordinate needs close direction and control, that the superior can make judgments about work standards, but that the subordinate is incapable of taking on responsibility for such judgments. As might be expected, the appraisal system based on the assumptions of Theory X has been a failure and degenerates into a soft approach. Usually the weaknesses that a superior sees in the performance of his subordinate are not so rated because the superior has learned that he will be put on the defensive by his subordinate if he tries to tell his subordinate of his weaknesses. New problems are then generated rather than the superior's having solved the problem of the subordinate's performance.

An alternative is to develop a performance appraisal based on the assumptions of Theory Y. This would fit into what Maier (1958) has called a "mutual problem-solving" interview. It might be

better done with the superior and his subordinates in a group (Likert, 1958). Performance appraisal is made more effective where the objectives have been agreed upon ahead of time by the superior and the subordinate. Then afterwards the superior and his subordinate can discuss the work and the extent to which the objectives have been met. The superior should find out how the subordinate sees the work situation before he makes any suggestions. In this way the superior may see the situation differently and will be prevented from making comments that will put the subordinate on the defensive and make him resistant to change. If the subordinate sees that the superior is trying to help him, he is less likely to be on the defensive and to be resistant to change.

JOB SATISFACTION

The problem of job satisfaction from a management point of view is to motivate employees so that they are interested in working with high productivity and quality. A study was made of the things which managers like and do not like in their jobs in the Stanford University Executive Development Program during the summers of 1961, 1962, and 1963 (Harrell, 1963). Two of the questions in an interview were, "What do you like most about your job?" and "What do you like least about your job?" Usable responses were available from 122 men. Their average age was slightly more than forty and average annual salary was approximately \$20,000. Partial results are shown in Table 18-1.

TABLE 18-1
Motivating Factors in the Manager's Job

Motivating Factors*	Most Liked			Least Liked		
	N	%	Rank	N	%	Rank
The work itself	47	31	1	27	25	1
Responsibility	37	24	2	12	12	5
Achievement	21	14	3	1	1	12½
Company policy and administration	5	3	6	15	14	3
Working conditions	2	1	8	18	17	2

* Factors based on the classification in Herzberg, Mausner, and Snyderman (1959). Some men gave more than one answer for "Most liked" and no answer for "Least liked."

The three most-liked aspects of the job were "the work itself," "responsibility," and "achievement." The three least-liked factors were "the work itself," "working conditions," and "company policy and administration."

A study of the motivation of a group of engineers and accountants may have some relevance to the interpretation of the job satisfaction of the Stanford managers (Herzberg, Mausner, and Snyderman, 1959). It was concluded from the study of engineers and accountants that the factors which these professionals most liked about their jobs were different from the factors that they liked least about their jobs. The factors that they liked most were more central to the achievement of the job and were called "motivating factors." The factors that they liked least were more peripheral to the job and were called "hygiene factors."

There may be some but not complete support for this two-factor theory of job satisfaction in the Stanford managers' results. "The work itself" was mentioned most often both as most-liked and as least-liked. The second and third items which were most-liked, however, were different from the second and third items that were least-liked. They are different both specifically and in concept. They appear to fit the two-factor theory. "Responsibility" and "achievement" which are second and third as most-liked appear to be "motivating factors." They are central to the job. "Company policy and administration" and "working conditions" which are second and third in being least-liked appear to be "hygiene" factors. They are peripheral to the job.

One comparison of job satisfaction of executives was present in a follow-up of a study begun with school children (Harrell, 1961). Terman tested ten-year-old children throughout the State of California to locate those with IQ's of 130 and over. Years later, after these superior children were grown and at work, he followed up and obtained information on their job satisfactions. The job satisfaction of those who had become executives in business and industry was just below the average job satisfaction for Terman's entire group. Of ten occupations, executives ranked sixth in job satisfaction. Forty-seven per cent of the executives reported a deep satisfaction and interest in their vocation and 43 per cent of them said that they were fairly content. By far the most satisfied

group was physicians, for 74 per cent reported deep satisfaction and interest in their vocation.

How To Raise Job Satisfaction. Some of the steps mentioned earlier, which have been contributed by scientific management, such as rest pauses and shorter hours, may have increased job satisfaction slightly. The motivation of employees through the application of Theory Y would no doubt result in even greater increases in job satisfaction. The emphasis should be put upon motivation rather than merely upon job satisfaction. The goal of management should be to arrange the situation so that employees are motivated to set their own goals for excellence in quantity and quality. The goal of complete job satisfaction is inappropriate because a satisfied need is no longer motivating. Thus the job of management is dynamic, changing, here as in other respects. The steps mentioned in applying Theory Y—decentralization and delegation, enlarging the job, democratic leadership, plus mutual problem-solving in the performance appraisal—will also increase job satisfaction.

In some relatively low-level jobs there can also be an increase in job satisfaction by employee control of the rate of work, and by the use of music.

Rate of Work. For greatest job satisfaction, and probably also for highest productivity, the rate of work is best left to the employees to set, rather than being controlled by management or engineers. The natural pace in factory jobs has been found to be slower at first during a warming-up period, with a later faster pace, and finally a slowing down during the end of a four-hour work stretch. The natural pace during a second four-hour work period is similar but slightly different. If employees are allowed to set their own pace, it is likely that overall productivity will be higher than management's prescribing a regular pace that is the same throughout the day.

Music. Job satisfaction is raised and there is some evidence of a slight increase in production when music is present as a background for routine jobs in the factory and in the office.

INFLUENCE

Behavior at work is influenced through management via the use of authority and power, as well as by peers through social control. In one study it was found that where the subordinate supervisor

had no influence on his own boss to get approval of his recommendations for promotions and salary increases, he could not motivate his employees as effectively as the supervisor who had some influence with his boss (Pelz, 1952).

Authority. Influence is often the use of authority. Authority can be defined as one kind of power that is formal and delegatable (Leavitt, 1964). It is power that enters the two-party relationship in an organization. For example, A has power over B where a third party has delegated the power to A. Authority is a tool to restrict behavior even if it frustrates. A major difficulty with authority is the likelihood of unfavorable side effects. Often a person over whom authority is directed will not like it and will not like the person who exerts the authority. "Authority seems to be most useful in short-term, specific situations, where B's retaliatory power is minimal, where the change sought is change in specific overt action" (Leavitt, 1964).

Power. There are several kinds of power, but its meaning in this context is power to reward, or coercive power to punish. Power to reward includes the power to promote, to give a salary raise, or a desirable job assignment. Coercive power is the power to fire, reprimand, fine, lay off, demote, or to give an unpleasant job assignment.

Although they have not often been thoroughly studied, power and politics are frequently important aspects of organizations. Politics is the process through which power operates (Dalton, 1959).

A study was made in one organization where power developed from the impact of certain personalities in key positions (Dalton, 1959). The powerful people were promoters. The most influential people in the organization studied averaged 42 years of age, while the least influential at the same levels averaged 55.5 years of age. There were three kinds of cliques or alliances using power in organizational politics. There were vertical cliques operated for mutual support by a man who occupied a high position and men in lower positions; horizontal cliques in which men at the same level operated to prevent a threatened action or to attempt to get something done; and random cliques which were based on similar social activities, e.g. membership in a yacht club, and included people of any level.

Social Control. Social control can bring conformity in contrast to independent behavior at work. One type of conformity is yielding to authority—as seen in the yes-man. Another is yielding to the majority. In one study, small groups of three or more were instructed to vote that a short line was the longer line in a comparison. Uninstructed subjects when confronted with this unanimity of incorrect opinion would also in many instances decide to vote that the short line was longer (Asch, 1958). The subjects gave the wrong answer in approximately one trial out of three under this social pressure. Social control explains why group pressure will cause employees to restrict output on the job even when they would earn more money, at least in the short run, if they did not restrict their output.

Cognitive Dissonance. The concept of cognitive dissonance has in recent years been the basic theory for more psychological research than any other (Festinger, 1957). When a person is faced with making a decision that involves conflict, he attempts to reduce the dissonance after making the decision. For example, if one is faced with the choice of picking one of two girls for a wife, after choosing one, the one chosen seems to become more beautiful, the rejected one, less beautiful. Similarly, if a manager has to choose one of two applicants as an employee, it is likely that the qualifications of the one chosen will appear better and the rejected one's qualifications poorer after the choice has been made. When one thinks that his pay is too high for the job, he will work harder to justify it than if one thinks that his pay is just right for the job. Reduction of dissonance is thus very widespread in explaining attitudes and behavior at work.

Communication Nets. The structure of communication networks has been shown in the laboratory to determine morale and productivity (Leavitt,

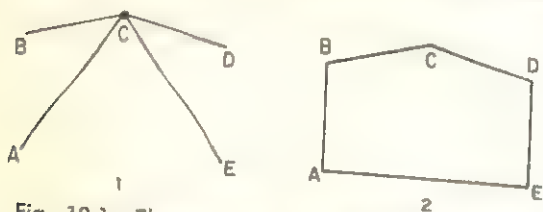


Fig. 18-1 The star and circle communications networks. (From H. J. Leavitt, *Managerial Psychology*, rev. ed., University of Chicago Press, 1964, p. 231.)

1964). A simple problem was solved faster by people whose communication was structured as in Fig. 18-1, Network 1, the Star, than it was by people whose communication was structured as in Network 2. In both instances there was two-way communication on each of the channels where a connection is shown. Morale was higher in No. 2, or the Circle Network. Consequently, an organization may be faced with deciding whether it prefers efficiency or morale.

When a more difficult problem was presented, the Circle Network was able to solve it, but the Star was not. This suggests that one kind of organization may be better for certain problems and a different kind of organization for other problems. The Star Network may be better for routine production and the Circle Network for research.

THE INDIVIDUAL IN ORGANIZATIONS

The organization often operates so that the individual, particularly at lower levels in large organizations, finds a conflict between his needs and the way the organization operates. This conflict is probably not inevitable. A more accurate and realistic view of the organization and individual needs can probably make the goals and operation of the organization consistent with individual needs.

Status and Social Structure. Although several variables correlate with job satisfaction, the highest correlation has been found with status. Those jobs with the highest status are those in which people experience the greatest satisfaction. While status is prominently caused by the perceived importance of jobs within the community, the social structure of the organization also can have a pronounced influence on status and hence on satisfaction and morale. If the social structure is such that the president communicates only with his vice-presidents and never with persons on lower levels, this may increase the morale of the vice-presidents. It will also probably result in lower morale for employees at lower levels. Employees at lower levels will have higher morale if they are in a social structure that allows maximum communication with various levels of managers.

Hierarchical Parameter. The typical big-business organization is arranged with authority flowing from the power at the top. This means that there is higher status at the top and lower status at the

bottom of the organization. Job satisfaction and morale of those at the top are high, but at the bottom they are low.

A different way of organizing along democratic leadership principles is in terms of a series of overlapping circles of decreasing size from top to bottom (Maier, 1953). Each circle represents an "Area of Freedom" which the superior may share with his immediate subordinates. The superior is in the middle of the circle. Each subordinate is on the circumference of the circle centered by his superior, but is in the center of a new circle if he also has subordinates responsible to him. Each intermediate supervisor or manager thus has a "linking-pin" function between two groups.

Staff-Line. The business organization following military organization is usually arranged, insofar as management positions go, into line and staff positions. Line jobs are those whose incumbents are responsible for the primary purpose of the organization, whether it is manufacturing, sales, or whatever. Staff men are the specialists who are advisory and consultative to the line managers. Generally the line managers have higher status and greater job satisfaction than the staff men.

Change, Flexibility, Size. The organization that is best fitted for change and flexibility may survive, but it may not be the one that is best geared for efficiency in routine production. This is suggested from the results of the studies of communication in small-group networks. In that situation, the star organization has been most efficient for routine production. The circle has not been so efficient in solving a routine problem. When there is a demand for change and flexibility, the star has been incapable of solving a new problem, but the circle has been capable of this flexibility. There may be situations as in electronics development where a smaller organization may be more efficient in meeting new problems. In routine production problems, the larger organization may be the more efficient.

SUMMARY

Maintaining fitness at work depends upon several things in the physical environment that are well understood and upon several more complicated but probably more important relationships in the psychological environment. For manual

labor the forty- to fifty-hour workweek seems to be optimal although for management jobs there seems to be no ill effects with workweeks up to 60 hours per week or higher. Under extreme conditions of temperature and low illumination, accidents are more frequent and production may suffer. These conditions are well-known and therefore rarely found in American industry today.

Maintaining employees' fitness to work through an optimal psychological environment is a challenge to management that probably can not be reached today but is nevertheless worth pursuing vigorously because of the potential rewards in productivity and morale. Managers have expressed a primary interest in knowing better how to motivate their employees. Such knowledge includes a recognition of the importance of social, ego, and self-fulfillment needs on the part of employees, and perhaps keener insight into the manager's own motivation.

Work behavior is influenced by the power and authority of management which in the long run often yield dysfunctional side effects of resistance, lack of cooperation, and antagonism. Participative management with group problem-solving has produced spectacular results in a few instances but has not been widely used at the rank and file level. Social pressure to conform to a work group's production norm is often a more important influence on employees than management's influence.

Perceived status in a work organization can account for the relative weight that a communication receives. Status seems to be the highest correlate with job satisfaction.

The social structure or network of communication channels has a bearing on satisfaction of individuals and the productivity of the group. While social structure follows the formal organizational chart to some extent, it is also modified by the informal organization. The informal organization allows power to be redistributed within the organization according to organizational political alliances.

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CHAPTER 19

Engineering Psychology

Man has been described as a "tool-using animal." This characteristic, although not entirely unique in the animal kingdom, is clearly high among those abilities which set the human animal apart. This ability to modify objects in his environment, and to create new devices has made possible his position of dominance over species possessing greater physical powers such as speed, strength, or endurance.

The development of tools, from primitive man's stone, wood, or bone clubs, scoops, and missiles to the intricate personal and industrial machinery of modern civilization, has followed a curve of ever increasing acceleration. Whether plotted in terms of complexity or in terms of power, the growth curve is exponential. For hundreds of thousands of years there was little change in the basically primitive nature of the devices used by man. Indeed, in both respects, the developments of the last century have exceeded manyfold those of all of previous history. Where early man had only his own strength to pit against his environment, each modern Western man has the equivalent of 3000 horsepower to work for him.

The curve of development of machines has paralleled that of many other related changes, from size of the world's population to the speed of locomotion; the most rapid growth in all these examples has occurred during this century.

One of the most spectacular developments has been in the expansion of knowledge. In some fields, particularly in the sciences, the amount of knowledge, as measured, for example, by the volume of publication, has been doubling every ten to fifteen years. One consequence of this growth has been the rise of the expert. The specialist in one limited field of knowledge may find himself incapable of coping with either the volume or the complexity of information in a related area. In attempting to reach a solution of some problem he may, therefore, call upon specialists in other fields to aid him. In some instances there are no experts to call on; the required information may not exist, or may exist in a form not readily usable. If the need is widespread enough, and important enough, the result will be the ap-

BY NEIL D. WARREN

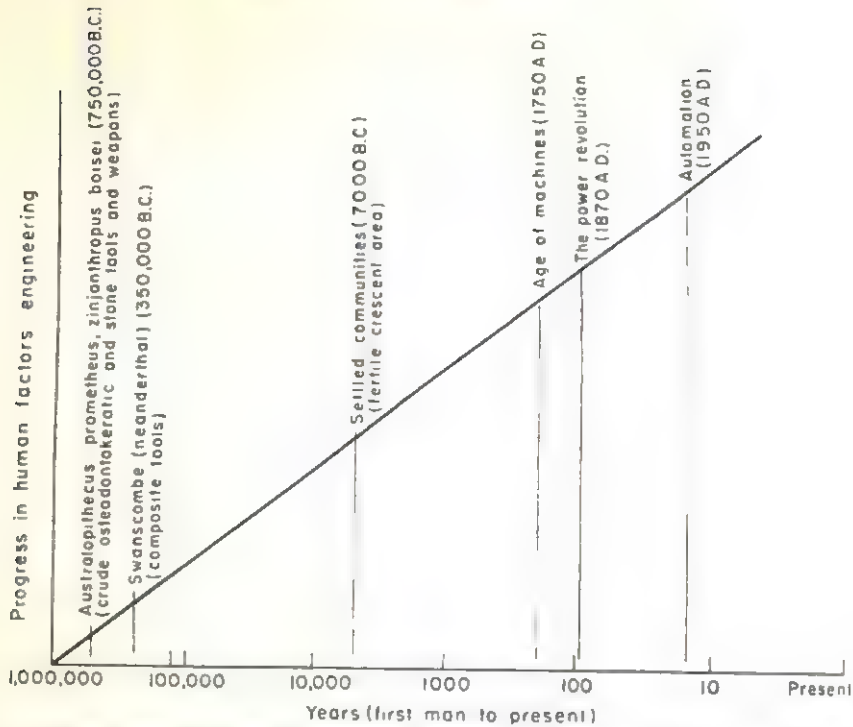


Fig. 19-1 Human factors engineering since the beginnings of man. (Christensen, 1962.)

pearance of a new specialist to find the information, to interpret it, and to help solve the problem. The engineer, a specialist in the management of the physical environment of man, may need to seek help from the experts on man himself.

HUMAN FACTORS IN ENGINEERING

When tools and machines were relatively simple, the engineer who designed them could rely largely on his own impressions or the opinions of a few associates to tell how effectively they could be used. The heft of a hammer, the length of a lever, or the style of numbers on the face of a clock could be determined without much "scientific" evidence. But, as complexity increased, as speeds became greater, as more precision was required, and as there were increased problems of efficiency and safety, more precise information about the human who would use the machine became necessary. For improved comfort and economy—and for competitive advantage—an anthropologist was asked to give the standard or average dimensions of the body to help the engineer design seats for a passenger train. With the introduction of airplanes capable of flying at high speeds and high altitudes, physiologists and physicians were asked to provide

information about the effects of increased acceleration and of decreased oxygen on the pilot's performance—and to aid in producing the required protective devices.

At the beginning of World War II, psychologists became involved in testing for selection and placement of military personnel. This was an activity for which they were prepared, having begun in World War I and having developed methods of testing and evaluation between the two wars. The magnitude of the testing and classification programs of the armed services during the second world war resulted in the employment of large numbers of psychologists, both in uniform and as civilians.

At the same time the increasing complexity of military equipment and technology presented problems for even the most carefully selected operator. A small group of psychologists, including some who had also been trained as engineers, became concerned with the need to design equipment for more effective human use. They drew upon experimental evidence in the fields of perception and psychomotor responses and began to conduct research with the equipment itself. The name applied to this activity was human engineering (Fitts, 1947).

The field of human engineering has expanded greatly in the last twenty years. Many companies producing the complex tools of modern civilization employ staff experts or consultants to work with the engineers who design the equipment. They participate in the planning and evaluation phases of product development. It is their aim to see that the machine takes advantage of the capacities of the human user and that it does not impose too greatly on his limitations. Many psychologists who do work of this kind describe it as human engineering. The majority, however, appear to prefer the term engineering psychology.¹

The human characteristics important in the design of equipment are, obviously, physiological and anatomical as well as psychological. Experts in these areas, and engineers, physical scientists, and others who have a concern for the human aspects of man-machine interactions, often work together. The term frequently used to describe their function is "human factors engineering." The list of academic specialties of members of the Human Factors Society in Table 1 will give an idea of the variety of backgrounds from which persons working in this field are drawn.

TABLE 19-1

Academic Specialties of Members of the Human Factors Society (Directory, 1963)

Specialty	Percent-age	Specialty	Percent-age
Psychology	58.5	Education	3.2
General	36.9	Industrial Design	2.6
Experimental	13.4	Physics	1.8
Industrial	4.6	Physiology	1.6
Others	3.6	Sociology	1.3
Engineering	13.0	Medicine	1.2
Mechanical	3.1	Anthropology	1.0
Electrical	2.7	Mathematics/Statistics	.5
Industrial	2.4	Human Factors	.5
Aeronautical	1.9	Biology	.4
General	1.7	Others	3.9
Others	1.2	Unknown	10.4

The interests of the members of the Human Factors Society indicate something of the range of activities of people working in this field. They include selection and training of personnel; learning and instructional technology; effects of stress, fatigue, confinement, drugs; design of displays and controls; design of man-machine systems; human problems in space flight. The employers of the

¹ The division of the American Psychological Association which is composed of members engaged in this field is named "The Society of Engineering Psychologists."

largest number of human factors experts compose the aerospace industry. Many others are employed in companies producing consumer products, such as automobiles and household appliances.

MAN-MACHINE SYSTEMS

A system has been defined as "any entity, conceptual or physical, which consists of interdependent parts" (Ackoff, 1961). We are accustomed to refer to the solar system, to an educational system, to a political system, to a highway system, to a telephone system, and to many others. Some systems consist entirely of inanimate objects, some of people, and some of ideas. Many are made of both people and physical objects. One of the best examples of a system is a biological organism. Indeed, the analogy to a living organism has often formed the basis for planning a synthetic system.

The implications derived from consideration of the interrelations between man and the machines he works with have only recently begun to influence the efforts of the design engineer. The result has been the development of the concept of the man-machine system. The concept is defined as follows: "A man-machine system is an organization whose components are men and machines, working together to achieve a common goal and tied together by a communication network" (Kennedy, 1962). Such a system may consist of one man and one machine, as for example, a driver and an automobile; or it may consist of large numbers of men and machines. An example of the latter is the Air Defense System which involves thousands of men and machines, geographically spread over thousands of miles but tied together by a common purpose and by a communications network. It is characteristic of a system that whatever happens to one element or component affects the total to some degree. This property is easily observed in a man-machine system.

It is customary to describe systems in terms of inputs, through-puts, and outputs. An input is an item of information introduced into a system. For the human component of the system we refer to the input as a stimulus. The through-put is the process which determines the action to be taken. Again in human terms, we describe it as making "a decision." The output is the activity, or change in activity, which results.

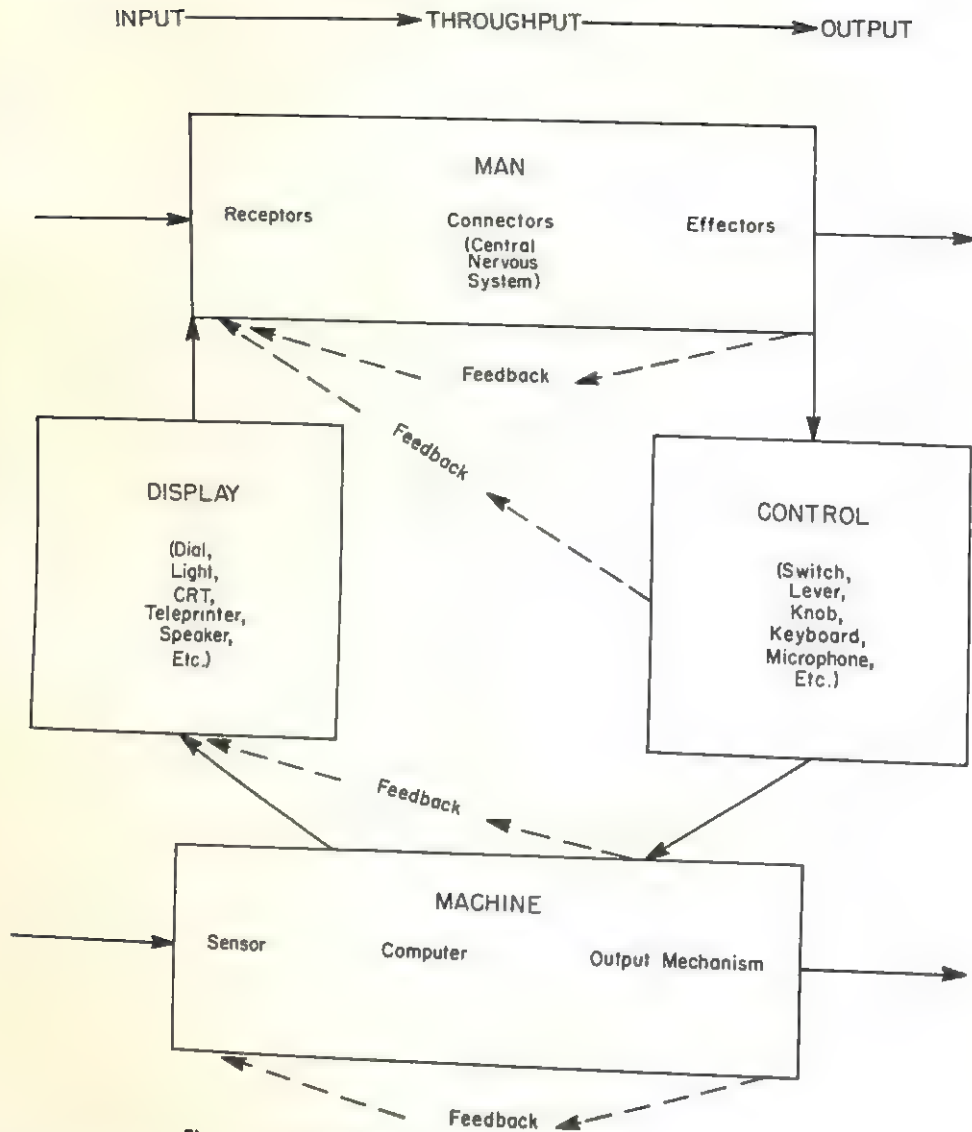


Fig. 19-2 Simplified diagram of a man-machine system.

A relatively simple man-machine system is represented by Fig. 19-2. The diagram is intended to show the general relationships that may exist between man and machine in such tasks as driving an automobile. Both man and machine have inputs from the environment; both may produce outputs which change relationships with the environment. However, as a system, the important aspects are the interaction between them; the flow of information from one component to the other. The displays are devices by which the machine communicates information derived from its sensing elements. The controls are means of communicating human decisions to the machine. The engineering

psychologist is primarily concerned with these two points of contact between man and machine, with displays and controls, with the man-machine interface. In basic terms, he desires to ensure the optimum flow of information between the two.²

The interrelationships diagrammed in Fig. 19-2 constitute a "loop." In complex systems there would be other loops which interact through networks of communication devices. Men may com-

There are other aspects of the relations between man and his mechanical collaborators with which the human factors expert is concerned: maintenance procedures and design for maintainability, safety, and comfort among them.

municate with one another directly, or only through machines. Machines may be linked to one another; for example, computers may communicate and interact without human intervention.

An essential aspect of a closed-loop system, shown in Fig. 19-2, is some provision for *feedback*. Feedback circuits introduce into the system information about the nature and extent of adjustive actions or outputs. They enable the system to correct errors or change the outputs. Several feedback connections are shown in the figure. They include: feedback within the man to a large extent through the proprioceptors; information derived from direct observation of the controls being operated or from changes in the displays resulting from the control operation; feedback within the machine characteristic of any servomechanism or automated system.

As man functions as part of a system he is obviously himself a system, or as relates to the whole, a subsystem. He has his own inputs and outputs. So also have other components. The physical parts of the system may be elaborate computers which can solve some problems more quickly and more accurately than man can. They may be sensing devices which can derive information from the environment which the human senses cannot do, or cannot do as well. (Sensing of infrared light is an example.) Mechanical devices commonly furnish the power to produce the output.

The systems designer must begin by asking several questions: What functions will be assigned to the various possible components? Is man to make a certain decision, or is it to be made by a computer? At what points in the total system are the special capacities of the human of particular importance? At which points can a mechanical or electronic device perform more efficiently?

The engineer might decide to eliminate the human component entirely. Indeed, an increasing number of systems have been produced which are completely automated—in which man has no role except as monitor and repairman. Even these two functions are becoming of less importance as the mechanical components become more reliable.

But if the designer decides that his system is to be completely automated, that it is to have no human component, he must be convinced that there is no necessary function that cannot be performed by the machine. This is a large order. Even

with the remarkable scope and the complexity of the giant computers, they are as yet no match for the human central nervous system in many very valuable capacities. They can perform computations of far greater magnitude and complexity than a man can, but are incapable of dealing with an unexpected, unprogrammed, situation. Man can improvise. He can draw upon an immense store of memories, some of which may scarcely appear pertinent, and use them to solve the new problem.

Man's perceptual abilities are assets not yet³ matched by machines. He can identify stimuli that are quite incomplete. He can discriminate "signal" from "noise," i.e., a meaningful pattern from a random or confused background. He has an especially valuable ability to make perceptual generalizations. Even though stimulus elements may vary greatly, the general configurations and context enable him to derive meanings in common from differing patterns. This is readily observed in interpretation of spoken words and in handwritten communication. For example, see Fig. 19-3.

It is at the output end of the system that man seems most limited as compared to machines. He has neither the strength nor the speed to perform many of the actions of machines. His muscles lack the endurance of mechanical devices. Even so, there are many intricate actions, calling for a high degree of precision and delicate coordination for which machines are no match for man.

These intellectual, perceptual, and motor skills are assets of great value. Even when science and technology advance to the point of duplicating them mechanically, it may not be economically or socially desirable to do so. On the other hand, there are situations in which it is extremely expensive, both in economic and in human cost, to use man in a system. The debate over the desirability of placing a man on the moon illustrates this problem. It is far more expensive to send a man to the moon and return him safely to earth than it would be to let intricate, and expendable,

³ One needs to be reserved in his statements about the limitations of machines. He would be rash indeed to use words like "cannot" or "will not" in attributing to machines any permanent or inevitable inferiority to man. Even a cautious "not yet" may be outdated by some scientific development already begun. For example, animals, and particularly humans, have had an apparently unique ability to modify behavior as a result of learning. This uniqueness is disappearing, however, with the development of learning machines, such as the perceptron (Block, 1962).

We all read different styles of handwriting so easily and so commonly that it is easy for us to overlook what an extraordinary ability this is. Note the extreme discrepancies in the way different people write certain letters of the alphabet. Now consider what kind of a machine would be necessary to "recognize" all these letters. IN PART, WE ARE ABLE TO READ THESE SAMPLES OF HANDWRITING because of the context and redundancy in this passage. But to a large degree, our ability to read this passage is also due to the remarkable capacity the human organism has for "perceptual generalization."

Fig. 19-3 An example of perceptual generalization. (Chapanis, 1961.)

robots do the exploration. Nevertheless, man is sufficiently superior to the machine to make the results of his investigation of far greater value. This, in addition to his desire to examine the unknown, may justify a decision to use him despite the cost. Indeed, the human factors not yet paralleled in the machine—emotion and motivation—are likely to be the most important variables in many decisions about the place of man in developing systems, and fortunately so.

In addition to allocation of functions to the various subsystems, the systems approach requires that the man, or men, to be involved should be selected and trained concurrently with the construction of the mechanical components. In effect, since the goals of the total system are known, the tasks to be performed by each part can be specified. The knowledge, skills, and personality characteristics of the human operators can be described.

They can be prepared for their tasks by use of such devices as simulators before the machine is completed. An example is the selection and training of astronauts for Projects Mercury and Gemini while the propulsion and control systems, the space capsule, and other components are in the development stage (Sells, *et al.*, 1961).

THE ROLE OF THE ENGINEERING PSYCHOLOGIST

The engineering psychologist is concerned both with the human requirements for the engineering design and with the preparation of the human to meet the requirements of the task he is to perform. Only the first of these is new, since industrial and personnel psychologists have been involved in selection and training for at least a half century.

The basic system design will determine the de-

cisions to be made by the human operator. The psychologist attempts to see that he is provided with the necessary information (inputs) in the most usable form and the one least subject to error. The devices which give him the information are displays. They may be dials, charts, cathode-ray tubes, signal lights, or other instruments. Or they may be auditory stimuli, including speech; they may be tactual, or even, if one proposal were adopted, olfactory.⁴

PROBLEMS OF DISPLAYS

The problems confronting the designer of displays are much less matters of limitations imposed by the sense organs than of the ways in which stimuli are interpreted or perceived. It is true, of course, that the engineer is aware that some people are color-blind and that a device for use by an unselected population should not depend on certain colors to convey information. It is true, also, that normal visual acuity sets limits on the size and the shape of stimulus patterns to be observed from fixed distances. Variations in the physical characteristics of sound, pitch, timbre, and intensity, are major factors in the meaningfulness of auditory displays; and this is a matter of the characteristics of the human ear.

Psychologists have not ignored such matters. Indeed, among the earliest applied research studies was an investigation of legibility of printed letters. The work of Paterson and Tinker (1940) was begun in the 1920s. Sanford published a study of legibility of small letters in 1887. These and other studies of the senses and their relationships to applied problems have been summarized in the *Handbook of Human Engineering Data for Design Engineers* (Tufts College, 1952).

RELEVANCE

The operator of a machine quite reasonably wishes to have all the information necessary for making a decision. Even if the chances of using a

particular item of information are remote, as in a rare emergency, he would much prefer to have the information available. This desire has led to multiplication of displays. For example, the instrument panels of commercial airliners contain hundreds of dials and indicators.

The designer and the operator of a machine must decide what kinds of information are relevant to the task to be performed. This requires a careful analysis of the operator's duties, the decisions he is to make, and the knowledge he must have in any foreseeable situation. An example of analyses of this nature was provided by the Army-Navy Instrumentation Program (ANIP) for development of displays for pilots of military aircraft (Douglas Aircraft Company, 1959).

The requirements included information about the position, attitude, altitude, and heading of the airplane; its speed relative to the ground and the air; "director" information indicating the flight path, altitude, and speed to fly; facts about engine performance, other aircraft, weather conditions, and many others. All of these items were believed to be relevant to the task of the pilot.

Irrelevant Information is any information that would add nothing to the operator's ability to make appropriate decisions. In some instances having knowledge of one set of facts will make others irrelevant. For example, in the ANIP analysis there was no listing of fuel quantity as a requirement. The relevant information was given in two items: Range Remaining and Endurance. Knowledge of fuel quantity, *per se*, has no value to the pilot of an airplane, or to the driver of an automobile, for that matter. It can only be used as part of a computation of distance that may be traveled or time of continued operation under a given set of conditions.

Many displays present information that is redundant. That is, it duplicates in a different form information the operator has secured from another instrument or external source. Some redundancy is inevitable. It is not necessarily bad. It permits the operator to verify data he has observed and it may increase the probability that he will note the information. It is also true that data often need to be presented in different ways for different uses, for emphasis, or for greater ease of interpretation. It would be possible, for example, for a pilot to estimate his rate of climb or descent from changes of his altimeter. Because of

⁴ It was suggested that in a system involving a limited number of independent electrical circuits the insulating material covering each be impregnated with a chemical which would release a distinctive odor if the wires became overheated. This would not only warn the operator but would permit him, it was hoped, to deactivate the circuit before serious damage, such as a fire, occurred.

the significance of the information, however, a separate rate-of-climb indicator is provided.

The display designer is concerned about reduction of irrelevant data because he knows that human input channels have a limited capacity. If the channels are overloaded, some of the inputs are not observed or are not properly interpreted. In more traditional psychological terms, this is a matter of the span of attention. Information theorists have developed mathematical ways of quantifying the amount of information conveyed by a display and have measured the capacity of the input channels. A practical example of what may occur if the capacity is overloaded is found in one of the most frequent aircraft accidents: landing without lowering the landing gear. Various warning signals have been used to prevent this accident. However, the number of items of information to which a pilot attends during approach and landing is large enough to cause him to ignore the warning with distressing frequency. The most common warning is a loud horn. Even when the horn was operating perfectly, pilots have reported that they have "failed to hear it at all," or that they were aware of the sound but that its significance "did not sink in."

An experiment by Olson (1963) gives evidence that the variables involved in input load can be measured and, to an extent, dealt with. He concerned himself with (1) the physical arrangement of visual displays, (2) the rate of information presentation, (3) the number of information channels employed, and (4) the spatial location of particular displays. Both time required to react to a particular unit of information and accuracy of performance in a simple tracking task suffered as the rate of information and the number of channels increased. The larger the number of data sources the operator must observe, the less information he was able to handle. The physical arrangement of the sources of data influenced both speed and accuracy of performance. Centrally located displays and more compact arrangements produced generally better performance.

ACCURACY OF INTERPRETATION

Once it has been decided that a given item of information is to be presented to an operator, the designer tries to choose the kind of display which will be least likely to produce errors. Many factors enter into the selection of modality, i.e., whether

visual, auditory, or other sense will be used. For a continuous record a visual display is most satisfactory; for a warning signal, an auditory stimulus has advantages; for indications of spatial relationships a visual pattern is more accurate than an auditory one.⁵ The nature of the visual and auditory background, the amount and kind of other instrumentation are among other variables that must be taken into account.

Quantitative information is most frequently presented on some type of dial or counter. The shape, the size, the number of divisions on the scale, the shape of the pointer, the direction of its movement, the design of the numbers or other symbols; these are among the many factors that affect the accuracy with which a dial may be read. For example, there is an optimum number of subdivisions on the scale of a dial face; too many will increase both errors and time of reading; too few cause the operator to make errors in interpolating between the marks.

Studies of various possible designs under experimental conditions will often determine the most desirable kind of display to use although engineering considerations or other factors may enter into the final choice. The altimeter which has been standard equipment for aircraft since the early days of flight is a round dial with three pointers to indicate 100's, 1,000's, and 10,000's of feet. Errors of reading this instrument have been sufficiently frequent to cause dissatisfaction with it. Grether (1947) undertook to compare the accuracy and speed of reading various altimeter designs with the results shown in Fig. 19-4. Clearly the counter was best under the experimental circumstances. For the practical situation, however, it has limitations both mechanical and perceptual. New altimeters have been developed following Grether's study. The design most likely to become standard is a vertical display with a pointer which moves up to indicate a climb and down for descent.

Another aircraft instrument illustrates a perceptual problem found in a number of displays: the matter of *reference*. If a display shows a relationship between an object, such as an airplane,

⁵ It has been demonstrated, experimentally, that a pilot can learn to operate an airplane by the use of sound. A system of Flight by Auditory Reference (FLYBAR) used changes in pitch, intensity, and pattern of sound as inputs to direct the pilot in controlling the airplane (Forbes, *et al*, 1945).

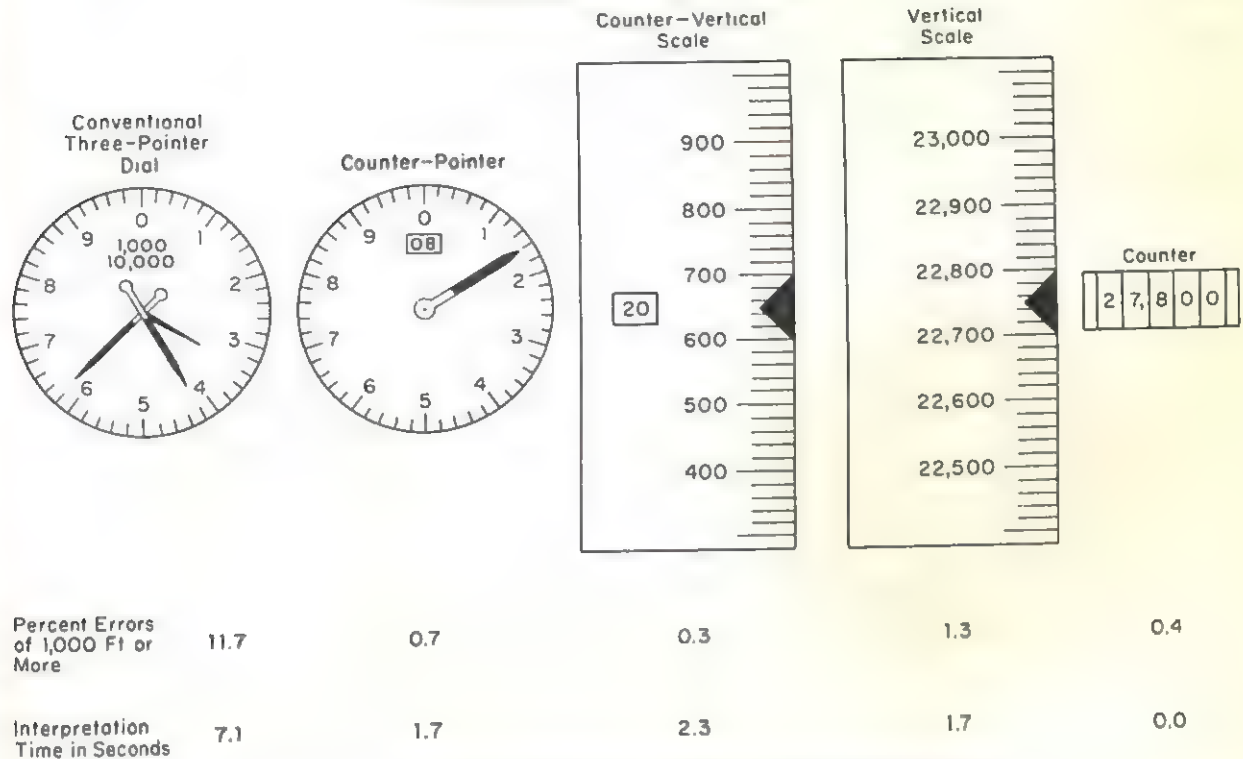


Fig. 19-4 A comparison of altimeter designs. (After Grether, 1947.)

and the real world, a determination must be made concerning the way in which one aspect of the display moves with reference to the other. The relationships may involve direction, distance, or attitude. The example shown in Fig. 19-5 is an aircraft attitude indicator, the artificial horizon. In the conventional instrument, shown at the top, the silhouette of the airplane remains stationary when the airplane changes its attitude in either pitch or roll; the line representing the horizon moves up and down for changes in pitch, and tilts to one side or the other for changes in bank. Although this is what a pilot sees through the windshield of his airplane, he interprets the visual pattern as meaning that the airplane has moved with reference to the earth rather than the reverse. Student pilots frequently, and even experienced pilots occasionally, misinterpret the moving element of the display. They perceive it as moving in the direction of the bank or pitch of the airplane. The lower instrument is more easily and more accurately interpreted. The relationships are the reverse of those in the conventional display; the moving part represents the airplane and the horizon is stationary.

Other instruments which involve questions of

reference include compasses, altimeters, and target displays. As in the case of the artificial horizon, it is often necessary to investigate the effects of various designs before deciding how best to solve the problem of reference.

INTEGRATION OF INFORMATION

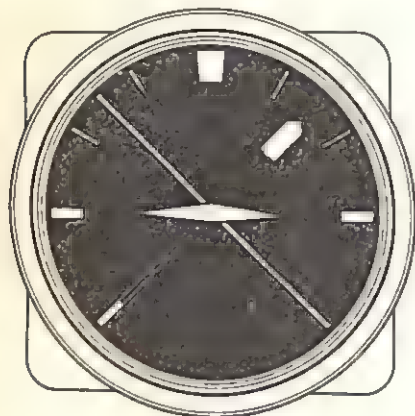
In many situations the information presented to the operator of a machine by a number of displays must be combined before the information is useful. Additional data known to the operator may also enter into the combination. The process may be a mental one or it may involve the use of such accessory devices as computers, slide rules, graphs, and tables. The necessity to perform calculations using quantitative data from a number of sources may delay the operator's response, and may introduce errors.

An integrated instrument presents the results of a computation performed, usually electronically, by the machine. For a simple illustration, the pilot of an airplane, knowing his geographic location and that of his destination, can calculate the distance between the two points. Reference to maps, use of measuring devices, and so on, might be involved. An integrated display would show

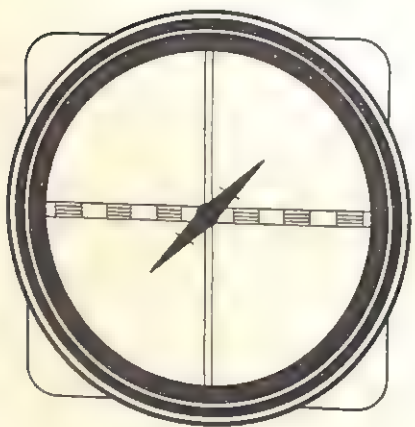
distance to destination directly. Other data might be added to the computation. Information about speed would permit the display to show expected time of arrival at the destination. The measurements of fuel quantity and rate of fuel consumption are related to distance and other factors to

the relationships among the various readings are readily apparent even without reading each specific dial.

An example of the pictorial type of display is shown in Fig. 19-6. This is an experimental airplane instrument panel developed by the Army-Navy Instrumentation Project. The upper display simulates the view of a pilot through the wind-



Standard Indicator



Preferred Indicator

Fig. 19-5 An example of difference in reference. Both instruments indicate an airplane in a left roll. (After Loucks, in Fitts, 1947.)

determine fuel range. An instrument integrating these facts would readily enable the pilot to make decisions regarding his flight plan or the operation of his engine.

The efforts to present integrated information have produced two kinds of displays. One is pictorial: the instrument represents in realistic or abstract form some aspect of the "real world." The other is a pattern of instruments so arranged that

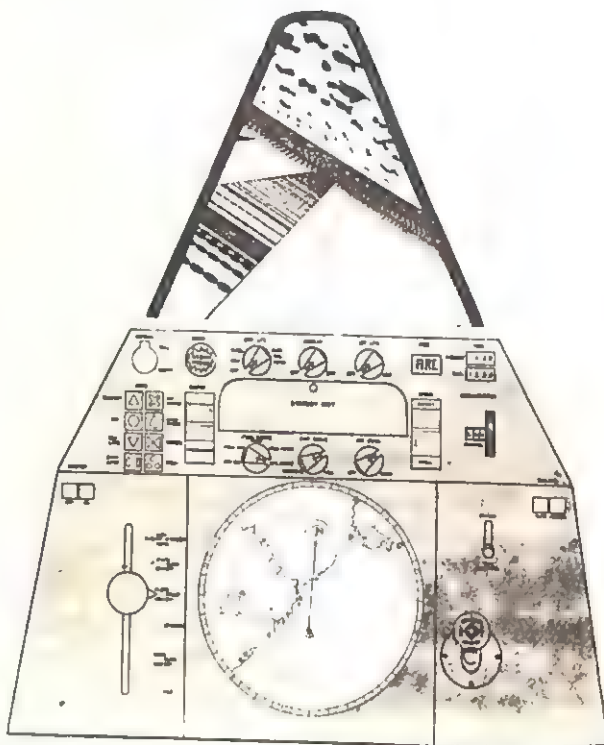


Fig. 19-6 The ANIP instrument panel. (After Bond, et al., 1962. See, also, Douglas Aircraft Company, 1962.)

shield of an airplane with the added feature of an electronically produced "roadway in the sky" down which the airplane is to fly. The lower display is a map-type instrument which shows the location of the airplane, its destination, and features of the terrain.

An integrated display of the pattern type (Fig. 19-7) is the Wright Air Development Center panel. The readings of the top instruments form a horizontal reference line which permits rapid recognitions of relationships. The instruments provide information about speed, altitude, and attitude of the airplane. The vertical reference line of the lower instruments is the basis for navigation.

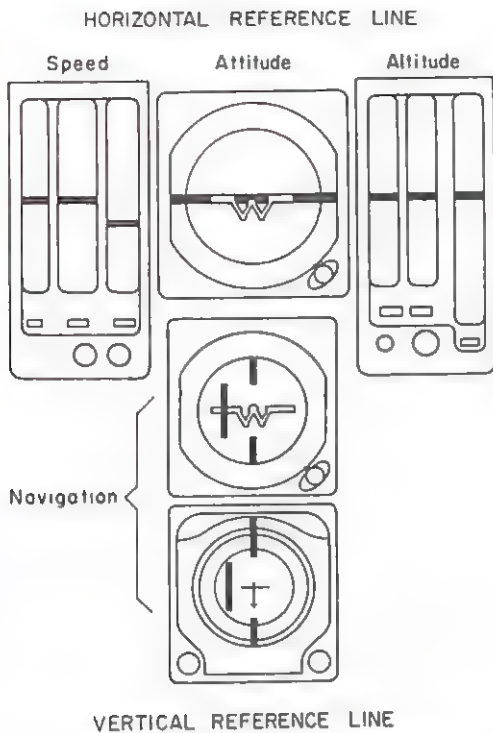


Fig. 19-7 WADC instrument panel. (After Bond, et al., 1962.)

PROBLEMS OF CONTROLS

In brief, the operator of controls must do these things: select the correct one; move it in the proper direction and to the right extent; operate it at the proper time. The last requirement may mean that he should activate the control as quickly as possible after he receives a signal, or it may refer to a sequence of controls which must be operated in a correct temporal relationship.

Although the human response mechanisms have obvious limitations (in strength, speed, and endurance, for example), they are capable of remarkably precise actions even in situations requiring very complex movements, such as speaking, playing a musical instrument, etc. The engineering psychologist tries to see that the task of operating controls takes advantage of the capabilities of the operator while it avoids imposing too greatly on his limitations.

ACCURACY IN SELECTION OF CONTROL

Identification of the correct control to be activated is an obvious essential. In many instances a

knob, a switch, or other control device is labeled. It is given a name or its function is described, often in abbreviated form. For example, the windshield wiper button in an automobile may bear the designation W. This is adequate for the purpose but such simplicity would be intolerable in a highly complex control panel.

Even when controls are labeled more completely there are occasions when such identification is not effective. This will occur when time or illumination are inadequate for reading labels, or when the operator has become so familiar with his equipment that he substitutes other means of identifying the controls.

He may, under such circumstances, use *location* as his cue. The experienced driver has little or no difficulty in choosing between brake and throttle pedals. The relationships between the two have become universally standardized. Other controls have not been located in such a standardized pattern, however, and in automobile driving as well as other situations serious errors occur. This is one example of the way in which habits may interfere with, rather than aid in, accuracy.

Shape coding of controls helps to identify them by touch as well as by sight (Ely, et al., 1956). We can discriminate among a considerable number of different shapes by touch alone. However, if it were necessary to use many of them in a single situation it would be difficult to recall which shape identified which function. Efforts have been made, therefore, to choose shapes that have a natural association with the function they serve. For example, it is common practice for the control which raises or lowers the landing gear of an airplane to be shaped like a wheel.

Identification of controls by *size* is a common experience. Usually the variations in size are primarily for other purposes, such as ease of operation, and only incidentally a factor in identification. In any case, size coding is limited by our difficulty in discriminating among objects differing in any reasonable range of sizes.

Color coding is frequently used to assist in identifying controls or situations related to hazards, such as employing orange color for high voltages. Changes in color discrimination with reduced illumination limit the effectiveness of the procedure. It can be useful, however, if illumination is not a factor; particularly because we have be-

come accustomed to associating red with danger, yellow with caution, etc.

ACCURACY OF MOVEMENT

The operation of a control in a correct or precise manner is influenced by a number of factors: the kind of movement required, the location of the control, its shape and size, the feedback information, external variables such as vibration, or illumination.

Movements differ widely in the way they are controlled and, consequently, in the function they can serve (Chapanis, *et al.*, 1949). In a *ballistic* movement the hand, for example, is thrown toward some target by a sudden muscular contraction. It is seldom required for control operation although in emergency situations it may be employed unintentionally. The accuracy of ballistic movements is determined by the initial muscle action pattern and is not modified to any great extent by the contraction of antagonistic muscles.

A *static* response, on the other hand, involves the interplay of sets of muscles antagonistic to one another. The actual motion in such a response is small but the muscles are in a state of prolonged contraction. Maintaining a steady pressure on the throttle of an automobile requires static reactions.

Positioning movements are most often used in operating controls. A hand (or foot) is moved to a control and halted at the desired position by contraction of antagonistic muscles. The interaction of muscle groups permits changes in the direction, rate, and extent of the movements while they are occurring. The movement may be in a straight line as in reaching to a switch; it may be rotary as in turning a knob; or it may have other patterns depending on the nature of the control to be operated.

The most important factor in positioning reactions is feedback. Without awareness of the movements and of their effects, they cannot be controlled. Various senses provide feedback information, proprioceptive, visual, auditory. For accuracy, the most valuable feedback is visual.

A type of movement pattern involving the same muscle dynamics as positioning is *tracking or continuous adjustment*. Following a target with a moving pointer is an example, or driving an automobile in relationship to the center line of a highway. The functions of the human operator in such a situation are according to Wohl (1961):

1. To select a reference (point, line angle, curve, etc.) from which to determine the vehicle misalignment or deviation (i.e., error).
2. To detect such errors.
3. To establish an error criterion.
4. To respond to the detected error (via the steering wheel) in such a manner as to maintain the vehicle within the established criterion limits throughout the duration of the steering task.

This is a complex operation and one of great practical concern in controlling many different kinds of equipment. Efforts to improve accuracy have taken many forms. Wohl, for example, studied the effects of changes in the dynamics of the control system. He proposed a velocity-modulated steering system in which the control movement and response relationship would vary with speed of the vehicle. The intention is to maintain a constant relationship between the operator's perceptions and his responses regardless of the speed of the vehicle. The intention is to maintain a constant relationship between the operator's perceptions and his responses regardless of the speed of the vehicle.

Another effort to aid the operator in a continuous control task has been to provide a *quickened display* (Taylor, 1957). In effect, such a display speeds up feedback. The operator is given information about control errors, or the rate of accumulation of error, before the machine has completed its response to his control manipulation. He can introduce corrective actions more quickly as a result.

A somewhat similar principle is involved in the *predictor display* (Kelley, 1960). By such a device a computer provides information about the effects of control actions on the system at some time in the future. The pilot of the X-15 aircraft, for example, has an instrument which predicts the altitude he will reach some seconds after the power has been cut off while in a climb.

CONTROL-DISPLAY INTERRELATIONSHIPS

It is clear from the preceding discussion that displays and related controls can scarcely be considered separately. Whether in the simple matter of location or the more complex relationships involved in "quickening," the effectiveness of the human operator requires attention to displays and

controls together. The following list of "principles" summarizes some of the items of concern. It refers to airplane cockpits but is basically applicable to many different systems (Bond, *et al.*, 1962).

1. *The Functional Principle.* Group together on a panel the displays and controls that have the same function.

2. *The Importance Principle.* The most critical displays and controls are placed in the easiest-to-see and easiest-to-reach places.

3. *The Standardization Principle.* From one airplane model to another, the fundamental display-control arrangement should be similar. Thus, landing gear and flap controls should be similarly placed and coded, regardless of airplane.

4. *The Load Distribution Principle.* No one sense or part of the body should be overloaded with sensing or action tasks that can be accomplished by other parts.

5. *The Optimal-Position Principle.* By the nature of the case, some displays and controls have an optimal location. For maximum arm pull strength, you need arm and shoulder involvement at a point straight out from the shoulder. Displays are easiest to see at eye height directly in front of the operator. Controls to be used blind should be in front and quite high on the panel.

6. *The Frequency-of-Use Principle.* Put most frequently used elements in preferred locations.

7. *The Sequence-of-Use Principle.* Take advantage of the sequence of actions in laying out a system. If control Y is always to be activated after control X, put Y next to X, etc. This principle is popular in submarine instrumentation where a single mistake in the sequence can have drastic effects.

8. *The Essential-Accuracy-Only Principle.* Do not give the operator more accurate information or require him to exercise closer control than is necessary.

9. *The Compatible Direction-of-Movement Principle.* A control movement should produce a naturally related effect on the appropriate display. Clockwise means "increase," up means "on," and so forth.

10. *The Unburdening Principle.* Relieve the operator of tasks which are intrinsically difficult for him. Thus, a man *can* act as a differentiator; i.e., he can estimate rates of change and accelerations in a tracking task. But by installing a mechanical or electronic differentiator in the loop,

the man's job becomes much easier for him. He then can act as a "simple amplifier."

11. *The Quickening Principle.* Provide the operator with timely knowledge of the results of his own actions.

DECISION-MAKING

The engineering psychologist is concerned with the human through-puts as well as the inputs and outputs. That is, he is interested in the process by which decisions are reached and the relationships between information provided by displays and control activation. In most operations where a high degree of skill is involved, human decisions are mostly automatic. They become more significant when unexpected or emergency situations occur.

Even when a decision is a matter of following the rules (i.e., if *this* happens, do *that*), it is essential that information be provided which clearly distinguishes between "this" and "not-this." In a more complex situation, rule-following may still apply if the process can be seen as a series of steps with the same kind of decision to be made at each step.

The kind of decision-making for which man seems better qualified than the machine, however, is not quite so simple. He often deals with a complex pattern of information and a wide variety of responses among which to decide. He will never have unlimited choices, of course, since he is neither omniscient nor omnipotent. There is, however, evidence that greater effectiveness of action is achieved if there is maximum freedom of response rather than in a rigid rule-following pattern (Kinkade and Kidd, 1959).

The basic features of man's decision-making process are (1) the awareness of the goals of the operation; (2) information provided by displays, etc., about the situation confronting him; (3) knowledge of the alternative actions available to him; and (4) understanding of the extent to which the actions, singly or in combination, will enable the system to achieve one or more of the goals. In one way or another psychologists have concerned themselves with each of these factors. However, with the exception of information displays, most of their research has studied the overall process.

Extensive investigation of decision-making has centered around game theory, probabilities, busi-

ness games, and the like. It is possible to simulate a practical situation with effective realism. In many studies computers have been programmed to simulate the problem to be solved. A single operator may be involved, as in the case of the pilot of a single-place airplane; or a number of persons may participate in making decisions, e.g., in the combat information center of a naval vessel. The more realistic a situation can be made, the more complex the variables involved seem to become, and the more unpredictable the rules for their interaction. To quote the paraphrase by Shure, *et al.*, (1963): "There are more things in the decision maker's heaven and earth than are dreamed of in the decision theorist's philosophy."

THE ENGINEERING PSYCHOLOGIST AS RESEARCHER

It is clear from an examination of the man-machine relationships in any system, that the principal role of the engineer-psychologist has been and will continue to be as a researcher. True, there are handbooks of data about human variables, and manuals for designers, from which solutions of specific engineering problems may sometimes be derived. The questions to which such rules apply, however, are usually quite simple, such as the shape or location of a control. More complex problems seldom find ready solutions in handbooks or other accumulated data.

The engineering psychologist, therefore, is often called upon to conduct research into limited aspects of the design problem or to participate in the evaluation of the entire system (Davis and Behan, 1962). In either instance the basic principles of research methodology apply, although in the more complex situations the problems of control of variables and of mathematical treatment of data become more difficult.

The range of research problems is great enough to challenge the interests of psychologists with a wide variety of emphases. The basic perceptual and motor aspects are of long-standing interest to the traditional experimentalist. The experimentalist concerns himself also with such diverse matters as the effects on behavior of high or low temperature, weightlessness, vibration, isolation, or distractions. The interactions among members of a group of human participants in system operation present problems of interest to the social psychologist.

The effects of sensory deprivation and isolation intrigue the clinical psychology researcher.

The distinctive aspects of the engineering psychologist's role in research, as contrasted to that of the traditional experimental psychologist, arise from the goals of each. As Finan (1962) points out, they are the goals of the engineer and the scientist, respectively—the scientist desires understanding; the engineer, control. These are not incompatible objectives. They are complementary. But they do determine to some extent the methodology to be used. The engineer's problems are derived from practical, rather than theoretical, considerations. The methodology, in respect to such questions as research design, population sample, statistical treatment, and so on, reflects the basic difference in point of view. The ultimate result of either type of investigation is, nevertheless, to augment man's knowledge of himself and his relationships to an increasingly complex environment.

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